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Four New Snakes (*Tropidophis, Dromicus, Alsophis*) from the Isla de Pinos and Cuba

ALBERT SCHWARTZ AND RICHARD THOMAS

The assembling of herpetological material from Cuba and the Isla de Piños over the past five years, principally under the sponsorship of two National Science Foundation research grants, has led us to study some of the snakes from these collections. We have been assisted in the field by the following men, all of whom deserve our commendation: Edwin B. Erickson, John R. Feick, Armando García, William H. Gehrmann, Rafael Hernández, Ronald F. Klinikowski, Dennis R. Paulson, Peter F. Pepe, Michael Phillips, Barton L. Smith, Willard M. Stitzell, James R. Talada and George R. Zug. We have had access to specimens under the supervision of Dr. Doris M. Cochran, United States National Museum (USNM); Dr. Norman E. Hartweg, Museum of Zoology, University of Michigan (UMMZ); Dr. Hobart M. Smith, University of Illinois Museum of Natural History; Dr. Ernest E. Williams, Museum of Comparative Zoology (MCZ); Neil D. Richmond, Carnegie Museum (CM); Dr. Philip W. Smith, Illinois Natural History Survey; Dr. Carlos G. Aguayo and Dr. Isabel Pérez Farfante, Museo Poey; and Miguel L. Jaume García, Museo y Biblioteca de Zoología de La Habana; all have helped in allowing us to study pertinent material. The illustrations are by Ronald F. Klinikowski, whose assistance was subsidized by a National Science Foundation Undergraduate Research Participation grant.

TROPIDOPHIS

Tropidophis melanurus Schlegel is known from Cuba and the Isla de Piños (subspecies *melanurus*), Grand Cayman and Cayman Brac (*caymanensis*) and little Cayman (*parkeri*). Although *parkeri*

was described as a full species by Grant (1940:44), its close affinities to the Cuban *T. melanurus* are obvious, and nothing is gained by retaining a binomial for this snake. Also allied to *T. melanurus* is *T. bucculentus* (Cope); we agree with Bailey (1937:45; also Schwartz and Marsh, 1960, in press) that this Navassan snake is related more closely to *T. melanurus* than to any other West Indian *Tropidophis*, but this relationship is not best expressed as a trinomial.

Barbour (1916) did not record *T. melanurus* from the Isla de Piños nor did Stull (1928). Barbour (1937:154) ultimately included it from the Isla; his reluctance to do so is puzzling since the Link collections, which formed the basis for his report contained two specimens from that island. We have collected 11 from the Isla and 64 from the Cuban provinces of Pinar del Río, Las Villas, Camagüey, and Oriente. Study of this series indicates that the Isla de Piños *melanurus* represent an undescribed subspecies; in addition, a small group from the southern coast of Pinar del Río is nameworthy and described herein. The Isla de Piños snakes, in honor of Edwin B. Erickson who accompanied the senior author in 1957, may be known as

Tropidophis melanurus ericksoni subsp. n.

Type: AMNH 82897, an adult female, from Bibijagua, Isla de Piños, Habana Province, Cuba, July 8, 1958, by G. R. Zug.

Paratypes: All from the Isla, AMNH 78600-04, Sierra de las Casas, W Neuva Gerona. A. Schwartz and Willard M. Stitzell, Dec. 28-29, 1957; AMNH 82894-96, east base, Sierra de las Casas, W Nueva Gerona, G. R. Zug, July 4-6, 1958; AMNH 78599, 5 mi. NE Siguanea, A. Schwartz, Dec. 27, 1957; AMNH 82898, Jacksonville, A. Schwartz, July 14, 1958; MCZ 46229-30, Jacksonville, Heath and Taylor, Aug. 13, 1941; CM 283, G. A. Link, 1912-13; CM 1521, G. A. Link, May 1910.

Distribution: Known only from the Isla de Piños.

Diagnosis: A subspecies of *T. melanurus* distinguished by low number of ventral scutes in both sexes, dorsal dark blotches or spots three or four scales long and in strong contrast to the light ground color; usually heavy spotting on posterior third of venter and underside of tail.

Description of type: Adult female; total length 758 mm., tail 65 mm. Body relatively stout, somewhat compressed, head distinct from neck; scales heavily keeled except for three lower rows on each side, middorsal row greatly widened and bicarinate on posterior fifth of body to above vent; dorsals 19-27-24; ventrals 195; subcaudals 33; anal single; spurs absent; preoculars 1-1; postoculars 3-3; temporals 2-3 on left, 3-4 on right; supralabials 10-10, 4 and 5 entering orbit, 6 excluded by lowermost postocular; infralabials 12-13.

Dorsal pattern; a combination of zigzag or staggered dark blotches, each involving three to four scales long, edged laterally by cream and a series of lines (see fig. 1). The paramedian dark dorsal blotches are usually staggered and in addition are joined to a median dark brown line which begins on the neck and continues to the vent, involving the median and two paramedian scale rows. Two other dark lines, one on rows 10 and 11, and one on rows 6 and 7, which begin anteriorly as a dark line from the naris through the eye and thence across the temporal area (bordered below by a cream stripe) and onto sides of body. Both of these lines continue to base of tail; approximately 44 zigzag dorsal blotches on each side; dorsal surface of head with a well defined dark pattern on a lighter tan ground; a median almost rectangular blotch extends from supraoculars across frontal, with a median anterior projection along the suture of the second prefrontals, posteriorly across the parietals and onto the nuchals to a distance of four scales; a dark blotch on the snout involves the internasals and the anterior edge of the first prefrontals (see fig. 2). Upper labials clouded with brown and infralabials have black discrete blotches, increasing in size posteriorly and extending as an irregular band on the side of neck on rows 2 and 3; dorsal ground color light tan, ventrally, the scutes are buffy with irregular black to dark brown blotches increasing in size and

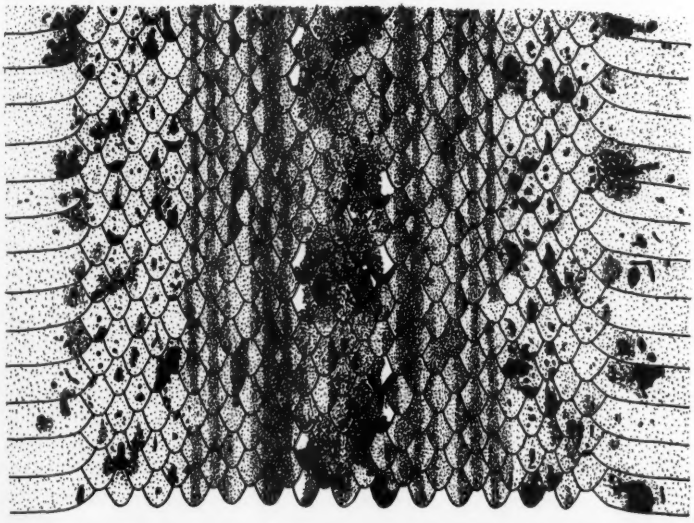

Fig. 1. *Tropidophis m. ericksoni*, type, AMNH 82897, pattern at midbody.

distinctness posteriorly and especially prominent on the posterior fifth of belly; underside of tail blotched with dark brown; tip of tail same as dorsum.

Variation: The paratypes include five males and nine females; the largest male is 642 mm. (tail incomplete); and the type is the largest female. Females appear to be slightly larger than males. Ventrals in males average 190.2 (188-192); females (including the type) 197.5 (189-203). Ventral counts taken by the method proposed by Dowling (1951). Subcaudals in males average 37.0 (35-38) and in females 34.1 (31-39). Males average fewer ventrals and more subcaudals than females. All have 1-1 preoculars, and usually 3-3 postoculars, (two have 3-4 and 2-3). Rows at midbody either 27 (9) or 29 (5); one has 24 at midbody; and a formula of 25-24-22. Supralabials always 10-10; infralabials vary from 11-11 (3), 11-12 (1), 12-12 (5), 12-13 (3), 13-13 (2), to 14-14 (1).

The paratype series show some chromatic and pattern variation. All have a light tan to buffy ground color, pale ventrals, and the cephalic figure of the type. Dorsally, the lines may be less prominent than in the type (such variation occurs in *m. melanurus*), and the degree of posterior ventral and subcaudal spotting may be less than described for the type, but not so reduced as in *m. melanurus*. Five have the tail tip black; including three males (one CM 283, is small) and two females (one, AMNH 78603, is large). The dark pigmentation of the tail is not correlated with size, but may be correlated with sex. This agrees with Alayo as quoted by Grant (1957:154). In smaller individuals, the postocular-temporal lateral line continues prominently along the neck, but becomes obscure with increasing size. Dorsal blotches are usually dark and prominent on the lighter ground color; usually involving 3 to 4 scales long and bordered laterally by a white or cream mark or line. Three (AMNH 78602-03, 82896) have paler dorsal blotches, and thus not so prominent against the pale ground color.

Comparisons: We have examined 11 of the Cayman races *caymanensis* (USNM 108042-43, MCZ 44862-64, from Grand Cayman; USNM 107975 from Cayman Brac) and *parkeri* (USNM 108009, MCZ 44865-68, from Little Cayman); however, additional information has been gained from the original descriptions of both forms (Battersby, 1938; Grant, 1940). Comparison of *ericksoni* with both forms shows that the Isla de Piños race differs in coloration; in *ericksoni* the dorsal blotches have the pale cream lateral edging but this feature is absent in all *caymanensis* (except MCZ 44862, which shows it faintly) and *parkeri* we have examined. Judging from juveniles only, the Cayman races are even more distinctly and boldly spotted than juvenile *ericksoni*. The only adult *caymanensis* has the dorsal pattern much obscured by a deeper dorsal ground color, and the relatively large blotches are discernible with diffi-

culty. *T. m. caymanensis* differs from *ericksoni* in that the latter seldom has midbody counts of 25 or 23, both of which are typical of *caymanensis;* we consider the single *ericksoni* mentioned above as having 24 rows at midbody abnormal. From *parkeri, ericksoni* differs also in lower number of ventrals (204-212 in female *parkeri,* 199-202 in males). The number of ventrals appearently cannot be used to differentiate *ericksoni* from *caymanensis.*

More pertinent comparisons are between *ericksoni* and the Cuban *melanurus. T. m. melanurus* is a remarkably variable snake, in color and pattern. Stull (*op. cit.*:41) described the variation in ground color as "from putty to reddish or ashy gray," and commented on the four more or less conspicuous longitudinal streaks and on the blotching, but added that the blotches may be completely absent. These comments are emphasized by our study of recent collections and selected older specimens, totaling 64 snakes which we regard as *T. m. melanurus.* We characterize the Cuban snakes as above, but in addition as having dorsal blotches usually only two scales in length or completely absent; a light venter which is seldom stippled, and spotting on the posterior part of the belly and underside of the tail light and inconspicuous to absent (fig. 3).

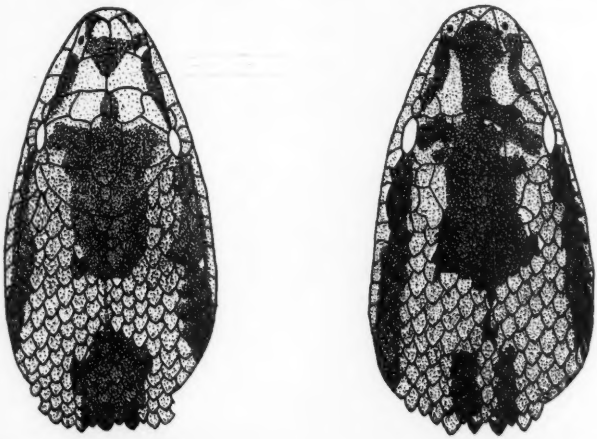

Fig. 2. *Tropidophis m. ericksoni,* type, AMNH 82897, dorsal view of head, showing absence of pigmented band between internarial and crown pigmented areas typical of the races *melanurus* and *ericksoni* (left).

Fig. 5. *Tropidophis m. dysodes,* type, AMNH 82893, dorsal view of head, showing pigmented bar between internarial and crown markings typical of the race *dysodes* (right).

Compared with the Isla de Piños snakes, *m. melanurus* differs in a higher number of ventrals, which average 202.3 (194-210) in males, and 206.9 (199-217) in females. There is no overlap between ventral counts in males of the two races, and of only five in females. The two races are alike in that both have similar cephalic patterns and both have the lateral margins of the dorsal blotches edged with cream or white. Scale rows at midbody of *m. melanurus* are usually 27 (42 specimens) or 29 (15), but aberrant counts of 24, 25, 26, 28, and 30 were obtained with 28 having the highest frequency.

Of all Cuban snakes examined, only one (AMNH 83364) resembles *ericksoni* in pattern and degree of pigmentation. It is from the humid north coast of Oriente, and is one of three from the vicinity of Baracoa; the remaining two are not so heavily pigmented. We regard it as the fortuitous occurrence of the saturated pattern within the population of *m. melanurus*.

During 1957 and 1958, the south coast of Pinar del Río was visited. Three *T. melanurus* collected there were recognized as being much darker than all others. We realize the inherent unlikelihood of a distinct race of this widely ranging and highly variable snake on the coastal plain of Pinar del Río, but it should be recalled that the equally wide ranging *Anolis sagrei* has differentiated in this precise area to form the very distinct *A. s. bremeri*, which occurs with the darkly pigmented boas herein described. This new boa may be called

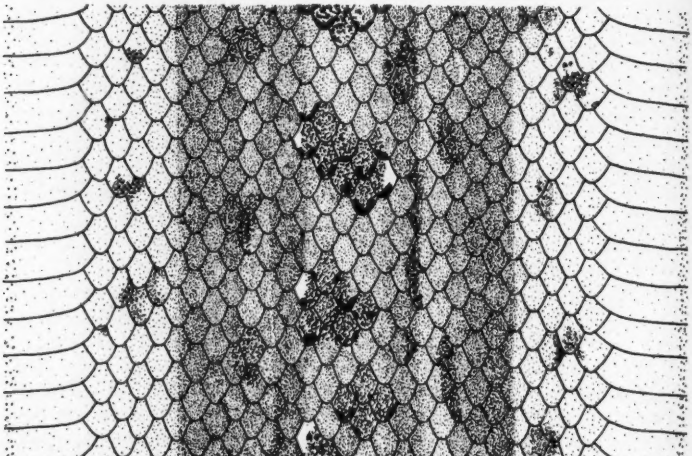

Fig. 3. *Tropidophis m. melanurus*, AMNH 79290, pattern at midbody; cliffs at San Jose del Lago, Las Villas Province, Cuba.

Tropidophis melanurus dysodes, subsp. n.

Type: AMNH 82893, an adult female, from one km. N of La Coloma, Pinar del Río Province, Cuba, Aug. 7, 1958, G. R. Zug.

Paratypes: AMNH 79261-62, same locality as type, June 25, 1957, Armando García and Dennis R. Paulson.

Distribution: Known only from type locality.

Diagnosis: A subspecies of *T. melanurus* distinguished by dark dorsal blotches three to five scales wide, not in strong contrast to dark brown ground color and margined laterally with orange; belly heavily stippled with brown, heavy subcaudal dark spotting and a median pigmented bar joining the dark rectangular cephalic figure with the dark area on the internasals and anterior portion of prefrontals.

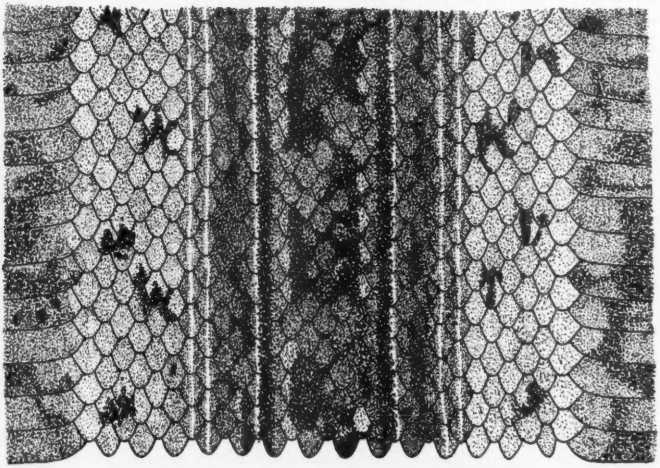

Fig. 4. *Tropidophis m. dysodes*, type, AMNH 82893, pattern at midbody.

Description of type: Adult female; total length 712 mm., tail 67 mm. Body relatively stout, somewhat compressed, head distinct from neck; scales heavily keeled, except for the four lower rows, middorsal row not greatly widened but with scales bicarinate throughout most of its length; dorsals 26-29-19; ventrals 202; subcaudals 36; anal single; spurs absent; preoculars 1-1; postoculars 3-3; temporals 3-4; supralabials 10-10, 4 and 5 entering orbit 6 excluded by lowermost postocular; infralabials 13-12. Dorsal pattern a combination of zigzag or staggered blotches, each involving three to five scales long, edged laterally by orange, and a series of longitudinal lines (see fig. 4).

The dorsal surface of the head has a well defined dark pattern on the slightly lighter brown ground color. A median, almost rectangular but posteriorly expanded blotch from the supraoculars across the frontal, with a median anterior bar extending along the prefrontal suture to form an elongate triangle with its base on the internasals; the large rectangle extends posteriorly for a distance of about four scales posterior to the parietals (fig. 5). The upper labials are suffused with dark brown and the infralabials are dotted with both dark and lighter brown, the dark pigment extending brokenly posteriorly on rows 2, 3, and 4 to form broken isolated dark brown blotches which continue along the side of the body and are restricted to one to three scales posteriorly. Dorsal ground color brown, somewhat lighter than the blotches. Ventral scutes are much stippled, clouded with brown and in life the ventral ground is pink; occasionally with brown organized into diffuse blotches which are hardly apparent due to the lack of contrast between them and the brown clouding. The underside of the tail has a series of distinct dark brown blotches and the entire tip is black.

Variations: Both paratypes are also females; of the three, the type is the largest, the paratypes 605 and 579 mm. respectively. For the three, the ventrals average 205.0 (202-207); and caudals 35.3 (33-37). All have 1-1 preoculars; 3-3 postoculars; rows at midbody 27, 28, and 29; supralabials 10-10; infralabials vary, 11-12 and 13-13.

Chromatically, the two paratypes agree well with the type. All three are dark dorsally, have the blotches relatively large, 47-51 on each side; edged laterally with orange and have the lines present but obscured due to the dark ground color. Ventrals always clouded and stippled with brown, having little or no distinct spotting, but with prominent blotching on the subcaudals; and with the tail black.

Comparisons: *T. m. dysodes* differs from all the races having a much darker dorsal and ventral coloration. Only a single *melanurus*, AMNH 83364 from the Baracoa area, approaches *dysodes* in dark color. No other specimens of *melanurus* examined have the cephalic rectangular figure joined to the internarial blotch by the median pigmented strip, even though both *ericksoni* and *m. melanurus* customarily have a nipple-like projection from the front of the rectangle. The Baracoa snake lacks the median bar as do all other *m. melanurus*. There are no differences between *m. melanurus* and *dysodes* scalewise. It appears that female *ericksoni* have less ventrals than female *dysodes;* comparison of *dysodes* with *caymanensis* and *parkeri* is difficult as we have seen only one female *caymanensis* and three female *parkeri*. Scalewise, *dysodes* appears to have more ventrals than *caymanensis*. At least *caymanensis* differs in having 23 or 25 scale rows in contrast to 27 or 29 in *dysodes*.

Remarks: *T. m. dysodes* is apparently restricted to the vicinity

of the type locality. All three were taken under palm logs in a moist palm forest near the coast. A single specimen from the Cabo de San Antonio (USNM 51853) is typical of *m. melanurus* in pale pigmentation. We have one *m. melanurus* from the Cabo, as mentioned above and another from El Guamá (USNM 27391), approximately 35 km. NW La Coloma. It is possible that *dysodes* occurs east and west along the southern coast of Pinar del Río Province.

DROMICUS

The generic name *Dromicus* has been firmly re-established for the small Cuban colubrid which has previously been called *Leimadophis* (Smith and Grant, 1958), and the name now stands as *Dromicus andreae* Reinhardt and Luetken, 1862. There are currently recognized two subspecies (*andreae*, and *orientalis* Barbour and Ramsden, 1919) from Cuba; the Isla de Piños *nebulatus* Barbour (1916) has been variously regarded as a full species and as a race of *andreae*. The relationships of this snake are so obviously with *D. andreae* of the Cuban mainland that we find little reason for maintaining its specific rank, and propose that hereinafter it be regarded as a subspecies of *D. andreae*.

During the current study a single *Dromicus* was collected in western Pinar del Río at the base of the Península de Guanahacabibes. Attempts to collect others on the Península itself or in nearby areas, as well as to locate specimens in other collections from the Cabo de San Antonio area have failed. The Pinar del Río snake differs in both scalation and pattern from other Pinar del Río material, of which we now have a large series, and the characteristics of our specimen do not appear in the race *nebulatus*. It is only in eastern Cuba, 1000 km. to the east that snakes which superficially resemble this serpent appear. In addition, the Península de Guanahacabibes is a center of subspeciation in several other Cuban reptiles (*Leiocephalus carinatus, Leiocephalus macropus, Leiocephalus stictigaster, Anolis quadriocellifer*); the plasticity of the genus *Dromicus* is demonstrated by the seven races (three mainland, four insular) of *D. parvifrons* in Hispaniola (Cochran, 1941:354 *et seq.*). We realize the possibility that additional specimens from extreme western Cuba may demonstrate that the race described below is not valid; however, we cannot relegate this individual to any of the described forms from Cuba. We hereby propose the name

Dromicus andreae peninsulae, subsp. n.

Type: AMNH 83235, an adult male, 3 km. W of Bartoli sawmill village, 10 km. SW of Cayuco, Pinar del Río Province, Cuba; July 10, 1957, by William H. Gehrmann.

Distribution: Known only from the type locality, but presumed to occur over the Península de Guanahacabibes.

Diagnosis: A subspecies of *Dromicus andreae* characterized by a high number of ventrals, no parietal stripes and a lateral band on rows 4 and 5 composed of a series of discrete dots.

Description of type: An adult male; total length 648 mm., tail 209 mm., incomplete. Body long and rounded, head distinct from neck; scales smooth; dorsals 17-17-15; ventrals 149; subcaudals 83; anal divided; preoculars 1-1; postoculars 2-2; temporals 1-2; supralabials 8-8, 3, 4, and 5 entering orbit; infralabials 9-9. Dorsal pattern consists of a black ground color with a series of obscure white transverse bands, white pigment restricted to posterior margins of scales; these bands so obscure as to render them impossible to count. Beginning behind the parietals, on scale row 6 is a lateral series of pale (light blue) discrete dots, which continue on the sixth row to the 82 ventral (fig. 6); at this point, by the loss of a row the

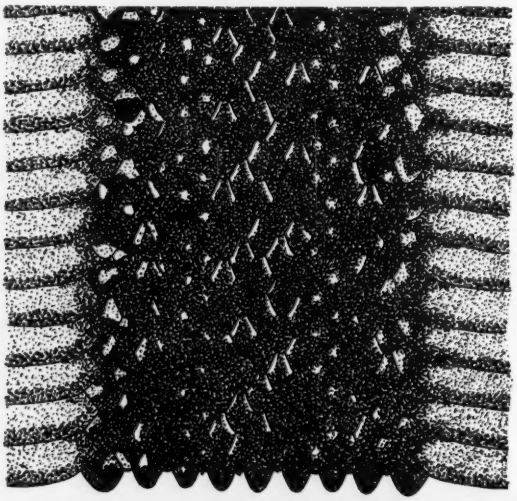

Fig. 6. *Dromicus a. peninsulae*, type, AMNH 83235, pattern at midbody.

series of dots falls on the fifth row and continues to the vent. A second row of dots on the fifth row commencing at the 29 ventral, shifts to the fourth row at the 82 ventral, and continues posteriorly concomitantly to about fourteen ventrals anterior to the vent, where it disappears. The effect of these two rows of dots is that of a longitudinal pale blue band, which is continued on the proximal part of the tail as a single series of more conspicuous dots. A faint yel-

lowish canthal stripe; two faint and irregular pale markings which represent the parietal stripes; upper labials white; infralabials and chin scutes white, with the sutures outlined finely in black; anterior ventrals white with a rather broad posterior black transverse band; this white ground color, proceeding posteriorly, is replaced by bluish gray, and the amount of posterior black pigment on each scute gradually increases, so that the scales anterior to the vent are more black than gray. The caudals retain this bicolor condition to the extremity; tail incomplete.

Comparisons: *D. a. peninsulae* is difficult to compare adequately with the other Cuban and Isla de Piños forms since it is known from only a single specimen. The following comparisons of *peninsulae* are with males of the other forms. In general, female *D. andreae* have fewer ventrals and caudals than males. From *D. a. andreae*, (28 males from the provinces of Pinar del Río, Habana, Matanzas, and Las Villas) *peninsulae* differs in higher number of ventrals (149; 136-146 in *a. andreae*), extreme reduction of parietal stripes (prominent to faint but never so reduced as in *peninsulae*); a lateral stripe composed of isolated dots (absent in all western *a. andreae;* see following comments). Of the 64 *a. andreae*, three have some indications of the lateral stripes; AMNH 46680 El Cotorro, Habana Province, which has dots on the fourth row near

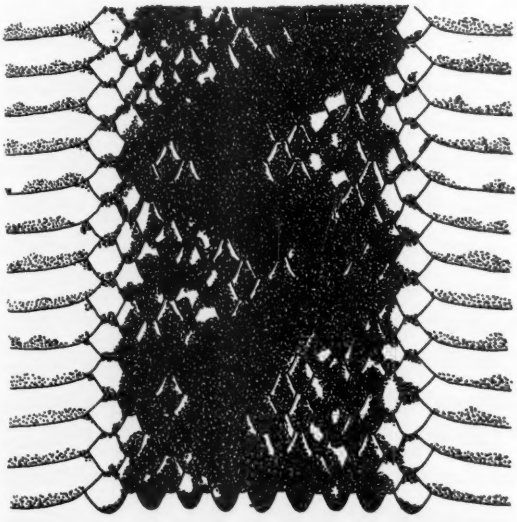

Fig. 7. *Dromicus a. nebulatus*, type, MCZ 11092, anterior pattern showing alternating pale lateral triangles.

the vent and faint dots on second caudal row, AMNH 83236, 6 mi. S Manicaragua, Las Villas Province, which has scattered dots on the fifth row and on the second caudal row, and USNM 56084, Trinidad, Las Villas Province, which has a definite band on the fifth row and on the second caudal row as well. The Habana specimen is a male, the others are females. It appears that occasional individuals within the population of *a. andreae* have some evidence of stripes on the fourth and fifth rows, but this character has not become established in any of the local *a. andreae* populations.

From *D. a. nebulatus*, *peninsulae* differs in a higher number of ventrals (149; 131-140 in 17 male *nebulatus*), and an absence of parietal stripes (regularly present in all *nebulatus*); the two races resemble each other in that both have bands on the fourth and fifth rows, although usually far more prominent (posteriorly) in *nebulatus* than in *peninsulae*, and the former has anteriorly alternating white lateral triangles (fig. 7).

From *D. a. orientalis*, (11 males from Oriente Province), *peninsulae* is difficult to distinguish. The ventrals in *peninsulae* fall within the known range of *orientalis* ventrals (144-157), the parietal stripes are faint to absent in *orientalis*, and the eastern race also has a band or dots on rows 4 and 5. However, the eastern subspecies is much paler, and the transverse white bands far more prominent than in *peninsulae*. The longitudinal stripes in *orientalis* are usually more prominent than in *peninsulae* (fig. 8). A hiatus

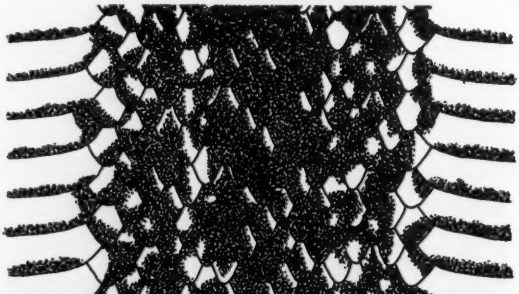

Fig. 8. *Dromicus a. orientalis*, type, MCZ 11726, pattern at midbody, showing prominent longitudinal pale stripes.

of some 1020 km. separates the easternmost locality for *orientalis* (Ensenada de Mora, Oriente) from the type locality of *peninsulae*; we regard the populations of *Dromicus* throughout most of Camagüey except for the extreme northwestern coast as intergradient between *a. andreae* and *orientalis*. It is not until one reaches the intergradient populations that a ventral count of 149 in males (AMNH 83250, 21 km. W Camagüey; UMMZ 72406, Tana) is encountered.

Remarks: We regard *D. a. peninsulae* as a local derivative of *D. a. andreae* on the extreme western tip of Cuba, in an area where local differentiation of other reptiles has been previously encountered. Additional specimens from the Cabo de San Antonio region will clearify the relationship of this subspecies.

ALSOPHIS

Cuba and the Isla de Piños are inhabited by a single species of *Alsophis*, which for many years has been called *Alsophis angulifer*. Recently, Smith and Grant (1958) have shown cause for changing this name to *A. cantherigus;* through a *lapsus*, even this name is incorrectly spelled both in the Smith and Grant paper and by Grant (1959). The proper name is *Alsophis cantherigerus* Bibron.

Two subspecies are known; *A. c. cantherigerus*, without definite type locality and occurring throughout much of the island, and *A. c. adspersus*, which occurs in Oriente. Recently, Grant (*op. cit.*) described *A. c. spielmani* from a series taken in the vicinity of Guantánamo, Oriente.

We have examined 126 *Alsophis* from Cuba and the Isla de Piños, as follows: Isla de Piños, 10; Pinar del Río, 56; Las Villas, 3; Camagüey, 15; Oriente, 42. Most of these are freshly collected specimens, but they include 17 paratypes of *A. c. spielmani*, of which only seven are adults or subadults. Looking at the entire lot, as far as scalation is concerned, there is no difference in counts of ventrals between the different populations. For example, males from the Isla average 172.0, from Pinar del Río, 169.6, *adspersus* from Camagüey and Oriente, 169.3, and *spielmani* 170.0. The same small differences exist in the females. In all populations with the exception of the Isla de Piños, females have a few more ventrals on the average than males; an exception in the Isla *Alsophis* is likely because of the few males (3) available. In the matter of caudals, so few specimens have complete tails that computation of averages is impossible. Again, in all populations except the Isla de Piños, females have a few less caudals than males. No population, excluding the Isla de Piños snakes, differs appreciably from other populations as regards caudals. In *spielmani*, the average of caudals of

males and females is close (116.4 in males, 114.1 in females), and males of this population apparently have a higher average number of caudals than do any of the others (110.0 Isla de Piños, 106.9 Pinar del Río, 108.3 *adspersus*).

The original description of *Dromicus* (*Alsophis*) *angulifer* var. *adspersus* Gundlach and Peters (1865:388) leaves much to be desired in the diagnostic features of this race. *A. c. adspersus* is supposed to differ from the nominate form in being smaller, and the color being much lighter yellow-brown without the formation of angular cross bands. The authors stated that many scales are sprinkled with black pigment which, especially on the anterior half of the body, forms small black scattered or converging spots. If we understand this description correctly, it does not describe a condition which has been latterly interpreted to mean having the anterior scales with persistent and conspicuous black edges, so that each scale has a yellowish-brown center and a black posterior edge. It describes on the other hand the bleached and lighter colored snakes from south coastal Oriente. Although *Alsophis* from much of Oriente and Camagüey have the black edged scales with yellowish-brown centers, the same condition pertains in *Alsophis* from as far west as Pinar del Río. When viewed together in large series, however, one can divide the Cuban snakes into two groups which correspond to the current concepts of *cantherigerus* and *adspersus* on the basis of other characteristics. In *cantherigerus*, the belly is not appreciably paler anteriorly than posteriorly and is uniformly gray to tan; in *adspersus* the belly is pale anteriorly, gray to tan posteriorly, often has red or yellow blotches posteriorly and on the caudals, or may even be entirely red. In *cantherigerus*, the throat is streaked or mottled with gray to blue-black and is never uniformly blue; in *adspersus*, the throat is grayish to blue. In *cantherigerus*, the black cap on the head is restricted, often so much so as to be represented by a dark interocular bar or to dark pigment along the head scale sutures; in *adspersus*, the head figure is present but diffuse. In *cantherigerus* the posterior dorsal color in adults is gray usually with some remnants of the crossbands still present, but in adult *adspersus*, the posterior dorsal color is darker and crossbands are not visible. We have found that these characteristics are more satisfactory for separating these two forms than the time-honored ones of pattern on the dorsal scales.

The type locality of *A. c. adspersus* is Caimanera, Oriente Province (Gundlach and Peters, *loc. cit.*). This village lies on the west side of the Bahía de Guantánamo, whereas the type locality of *spielmani* is Guantánamo. We can visualize no ecological barrier in this xeric region to such widely ranging snakes, and suspect that *spielmani* may be a synonym of *adspersus* (see comment above on original description of *adspersus*). However, we lack

fresh topotypes of either form and are reluctant to make this change formal. Should such a step become necessary, the snakes which we are calling *adspersus* from throughout Oriente and Camagüey would require a new name, and *A. c. adspersus* should then be applied to the south coastal populations.

At present we regard *A. c. spielmani* as a valid form. It is characterized by a pale coloration dorsally and ventrally, and by an absence or reduction of the black crown cap. We cannot maintain its distinctness on the basis of scalation, except, as mentioned above, *spielmani* males average higher in caudals than either *cantherigerus* or *adspersus*. Anteriorly, the dorsals show less black edging than do the scales of any other population, and this in addition to the tan ground color, increases the pale coloration of *spielmani*.

We have collected a series of 10 *Alsophis* from the north coast of Oriente, and have borrowed four. It is not surprising that this extremely mesic north coast supports a race which is derived from *adspersus*, but is distinct. For this northern coastal population, in honor of Peter F. Pepe who helped secure the series, we propose the name

Alsophis cantherigerus pepei, subsp. n.

Type: AMNH 83639, an adult female, from 9 km. W and 2.5 km. S of Baracoa, Oriente Province, Cuba, August 10, 1959, by Ronald F. Klinikowski.

Paratypes: (all from Oriente Province, Cuba) AMNH 83640, Baracoa, A. Schwartz, Aug. 12, 1959; MCZ 47044-46, camino al Toar, Baracoa, G. Canet, 1943; AMNH 63643, 1 km. W Mata, R. F. Klinikowski, Aug. 14, 1959; AMNH 83641, Taco Bay, 3 km. S of coast, A. Schwartz, Aug. 11, 1959; AMNH 83648, Taco Bay, A. Schwartz, Dec. 21, 1959; AMNH 83649, Taco Bay, M. Phillips, Dec. 22, 1959; AMNH 83651, Taco Bay, A. Schwartz, Dec. 26, 1959; AMNH 83652, Taco Bay, A. Schwartz, Dec. 27, 1959; AMNH 83650, 2 mi. S Taco Bay, A. Schwartz, Dec. 26, 1959; MCZ 10915, Mayarí, J. L. Peters, Aug., 1915.

Distribution: Known from the north coast of Oriente Province, Cuba, from the vicinity of Baracoa west to Mayarí.

Diagnosis: A subspecies of *A. cantherigerus* distinguished by dark dorsal coloration both anteriorly and posteriorly, ranging from dull brown to black, with poorly defined or absent posterior crossbands, belly distinctly bicolor, black posteriorly and pale anteriorly, blue throat, and very diffuse dark head figure.

Description of type: An adult female; total length 1325 mm., tail 327 mm., incomplete; scales smooth with two apical pits, and in 17-17-13 rows; ventrals 177; caudals 89; anal divided; preoculars 1-1; postoculars 2-2; temporals 1-2, both sides; supralabials 9-8,

3, 4, 5, and 6 entering orbit on left, and 3, 4, and 5 entering orbit on right; infralabials 10-10. Dorsal pattern anteriorly, of scales centrally brown and edged with a wide black band on their free edges, band often covering more than three quarters of each scale. At about the level of 97th ventral, the dorsals are entirely black and this persists to the tip of tail, without pattern. The dorsal surface of the head is dull olive and the central black cap is a diffuse dark area involving the supraoculars, frontal, and parietals, and extends to the furrow above the supralabials. All but the posterior supralabials are distinctly bluish, as are the infralabials and the anterior chin shields, and a somewhat lighter blue extends posteriorly to the fourth ventral centrally and along the margins as far as the tenth. Anterior ventrals are pale tan, with black free edges beginning on 9 and becoming increasingly prominent so that by ventral 57, much of each scute is black with only a small central tan area, and by 73 they are completely black except for occasional tan blotches on the most anterior dark ventrals. The remainder and all caudals are velvety black. The blue of the chin extends dorsally onto the dorsal rows immediately posterior to the last supralabial and continues posteriorly along the sides of the neck until obliterated by the tan and black dorsal pigments.

Variation: The paratypes include seven females and six males. The largest female is 1355 mm. total length, with an incomplete tail 300 mm. The largest male is 985 mm. total length, and with a complete tail 308 mm. However, males are larger in size than this one and females reach a larger size than males. Ventrals in males average 170.2 (166-173) and in females 173.0 (168-177). Caudals in two males with complete tails are 120 and 129; and no female has a complete tail. All have 1-1 preoculars and 2-2 postoculars, and 1-2 temporals. Scale rows are 17 at midbody on all but one (AMNH 83648), which has 15. Usually, the formula is 17-17-13, but anterior counts of 14, 15, and 16 occur. Supralabials 3, 4, and 5 enter the orbit. Infralabials 10-10 in all but three, which have 10-11.

Adults agree with the description of the type in the distinctly bicolor belly, pale anteriorly and black posteriorly. The posterior portion of dorsum is usually dark without any remnants of the dorsal crossbars which typify *cantherigerus*, but smaller snakes (*i.e.*, AMNH 83643, a male, t-l 780 mm.) show both the posterior crossbands and incipient posterior ventral darkening. It is apparent that both the dorsal and ventral dark coloration is an ontogenetic change best shown in adults. Such changes do not occur in *cantherigerus* or *adspersus*. We have not seen small snakes which we would assign to *pepei*, but doubt that they would differ markedly from juvenile *adspersus*. The single snake from Mayarí is a young male and has the posterior crossbars very evident against a light tan ground; the anterior dorsals are heavily edged with black, and

the posterior ventrals are black. We regard it as *pepei*, but it may in fact represent an intergrade between *pepei* and *adspersus*.

Comparisons: Of the three Cuban and three Cayman subspecies of *A. cantherigerus*, *pepei* differs from *fuscicauda*, *caymanus* and *ruttyi* in having fewer ventrals in both sexes. From female *caymanus*, *pepei* differs in having a black belly posteriorly, rather than slate gray with rosy spots and in lacking the posterior crossbands. There are no scale differences between *pepei* and *cantherigerus*, *spielmani*, and *adspersus*. The new subspecies differs from the latter three in having the bicolor belly, a saturated dark color dorsally and a blue throat. The throat of *adspersus* may be grayish to blue, but never extensive as in *pepei;* in addition, *adspersus* regularly has yellow or red markings on the ventrals, a condition never observed in *pepei*. Of the four Cuban races, *pepei* has the darkest and most saturated coloration, and *spielmani* the palest. This is not surprising since the former occupies one of Cuba's most mesic areas and the latter Cuba's most xeric region.

Remarks: One specimen (AMNH 83642, a subadult female, from the mouth of the Rio Yumurí, Oriente Province) we consider an intergrade between *pepei* and *spielmani*. Geographically, this locality is near Cabo Maisí, whence no specimens are available, but at which place we would assume on zoogeographic grounds to find *spielmani*. It resembles other subadult *pepei* in having the posterior belly gray rather than black, and the major portion of the belly is pale cream. Dorsally, the snake is pale anteriorly and gray posteriorly, with only faint indications of crossbars, not due to the deepening of the posterior ground color but rather to the extreme restriction of the black crossband pigments. This snake may be an aberrant *pepei*, but because of its combination of characters and provenance, we regard it as a *pepei* x *spielmani* intergrade.

The series of ten *Alsophis* from Isla de Piños presents certain problems of allocation. All but the two juveniles have the posterior part of the belly gray to dark gray. There is no distinctly bicolor condition, and the dark posterior color blends gradually into the paler anterior ventral coloration. The throat is never bluish as in *pepei* but rather shows bluish-gray mottling and streaking, much as in western *cantherigerus*. The head figure is diffuse and somewhat restricted but never so much as in Pinar del Río specimens. As a group, these snakes are easily distinguishable from the Cuban races, but because of the anomalous condition of apparently higher ventral counts in males than females (thus reversing the usual trend in the species), we are reluctant to describe them as new at the present time. Also, two of the three males are from the south coast of the Isla (Puerto Francés and Caleta Grande) and these are the only ones with high ventral counts (170 and 178).

Two fresh specimens from extreme western Cuba are from the Península de Guanahacabibes (AMNH 81226 and 83216). These

resemble *spielmani* in coloration and absence of pattern; anteriorly the dorsals may or may not be barely edged with black, posteriorly, the black crossbands are absent and the dorsals are uniformly pale tan. These snakes may represent still another race restricted to extreme western Cuba.

In addition to the large number of juvenile *spielmani,* we have also seen two juvenile *cantherigerus* and one juvenile *adspersus.* The juvenile *adspersus* and *cantherigerus* appear indistinguishable. Young *spielmani* are very distinctly marked, as Grant (*loc. cit.*) has described. The lateral streaking on the neck and extremely reduced head pattern are diagnostic.

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The Ultimobranchial Body of the Anura of Israel

By Dvorah Boschwitz

I. INTRODUCTION

The ultimobranchial body was mentioned as present in *Rana* and *Bufo* by de Meuron in 1886, and subsequently numerous authors confirmed its presence in other Anura, the first detailed description being given by Maurer in 1888, who characterized it as an "independent structure posterior to the gills" and therefore applied the name "Postbranchialer Körper." When it became clear, however, that the organ developed from the epithelium of the last branchial arch rather than as an independent structure, its name was changed to the ultimobranchial (Greil, '05) or telobranchial (Elze, '08) body. More recently, Watzka ('33) gave a detailed description of the organ in *Rana fusca* and Sterba ('50) and Saxén and Toivonen ('55) independently investigated its development in *Xenopus laevis*.

No simple homology exists between the ultimobranchial bodies of the various groups of Gnathostomata. The organ develops always from the epithelium of the most posterior branchial arch, whatever its number e.g. the fifth arch in mammals and certain birds, the sixth in amphibians and others, the seventh in sharks and in *Acipenser* (Van Bemmelen, 1886). In this paper also, the term ultimobranchial body is applied to the structure developing from the last branchial arch on the basis of similarity in development, morphological differentiation and histology at the peak of development, as is also conventional with the thymus and parathyroid (Pischinger, '37; Rauther, '37).

Some authors dismiss outright the view that the ultimobranchial body arises from a branchial arch on the ground, that it is found unilateral in a number of sharks, fishes and urodela (Brachet, '26), whereas the gills are invariably paired. In a number of these, however, it has been found that the anlage is originally paired, but that an unilateral degeneration later sets in. Such a process may be more universal, but sufficiently early stages for the primordia of paired anlagen to be observed have not always been studied.

The present work is a comparative study of the development and histology of the ultimobranchial body of the common anurans inhabiting Israel, with special reference to the changes caused by metamorphosis. It is a part of a more comprehensive, experimental study concerning the activity of the organ which is supposed to be included in the endocrine system. The results of these experiments will be published elsewhere.

II. MATERIAL AND HISTOLOGICAL METHODS

The animals used were of various ages, ranging from larval

stages to adults some two years after metamorphosis. A total of 112 animals of both sexes were examined, distributed as follows:

Hyla arborea L.	24,	*Rana ridibunda* Pall.	15,
Bufo viridis Laur.	26,	*Pelobates syriacus* Boettger	47.

Tissues were fixed in 6-10% formalin or Zenker-formol. Complete series of transversal sections were prepared, extending from behind the eyes to the caudal apex of the heart, so as to include the pituitary and thyroid glands as well as the ultimobranchial body. In young tadpoles it was necessary to include also the eyes, since at this age the thyroid gland reaches to a point anterior to the hypophysis.

Sections were generally 10μ thick, only occasionally it seemed more useful to have sections of 8μ and 15μ. Ehrlich's Hematoxylin and Eosin were adopted as standard staining; Hotchkiss' stain proved excellent for follicular contents. Differences between the sexes as well as those between young and mature adults, and seasonal changes were ignored.

III. ANALYSIS OF DEVELOPMENT, MORPHOLOGY AND HISTOLOGY OF THE ULTIMOBRANCHIAL BODY

In the Anura studied here, the ultimobranchial body invariably develops as a paired thickening or invagination of the epithelium close to the aditus laryngis. This rudiment grows ventrad into the underlying mesenchyme and soon becomes invested with a capsule and capillaries from the art. branchialis. A cavity appears in the bud as it rounds off with the severance of the connection with the epithelium above it. Thus a glandular structure lacking an excretory duct has developed (Fig. 1). Marked differences between the four species appear later: The cellular proliferation produces a single large follicle with a spacious lumen in *Hyla* (Fig. 4), a single follicle or more often a pair of follicles in *Rana* (Fig. 5), numerous small follicles in *Bufo* (Fig. 8), and a coiled, elongated tube in *Pelobates* (Fig. 6); this tube is later transformed into an ovoid complex of numerous follicles (Fig. 7). The generic variability of the organ in different Urodeles has been remarked upon by Wilder ('29).

The epithelium of *Hyla*, *Rana* and *Bufo* is simple at the outset, with nuclei of various forms—spherical, elongated, and L-shaped—crowding closely together. These may represent various stages in the cell life cycle or reflect the reciprocal pressures exerted by cells lying in close juxtaposition. In *Pelobates*, only rounded and ovoid types have ever been observed. In none of the early tadpole follicles does the epithelium as a rule become folded into the lumen, but in all except *Pelobates* the cytoplasm of individual cells is raised by the elongating nuclei into a palisade of bulging domes protrud-

ing into the lumen (Fig. 3, 4). Undegenerating nuclei are observed half-in and half-out of the cells, extending into the lumen through the disrupted cell membrane and also totally within the lumen (Fig. 3), together with nuclear and cellular debris. Gaps are sometimes to be seen in the row of epithelial cells in *Rana* and *Bufo* tadpoles, as if a cell had been extruded at that point (Fig. 2). In *Pelobates*, the free cell border remains flat and undomed, and the nuclei unelongated and never seen to leave the cell, and the gaps indicating the extrusion of cells never to be found. In the *Pelobates* adult, however, numerous nuclei do find their way into the follicular lumen. Supino ('07) already described epithelial cells within the lumen of fish ultimobranchial bodies.

In all tadpoles, a scant amount of amorphous coagulum, staining only faintly with eosin, appears in the lumen, the extruded nuclei becoming embedded therein.

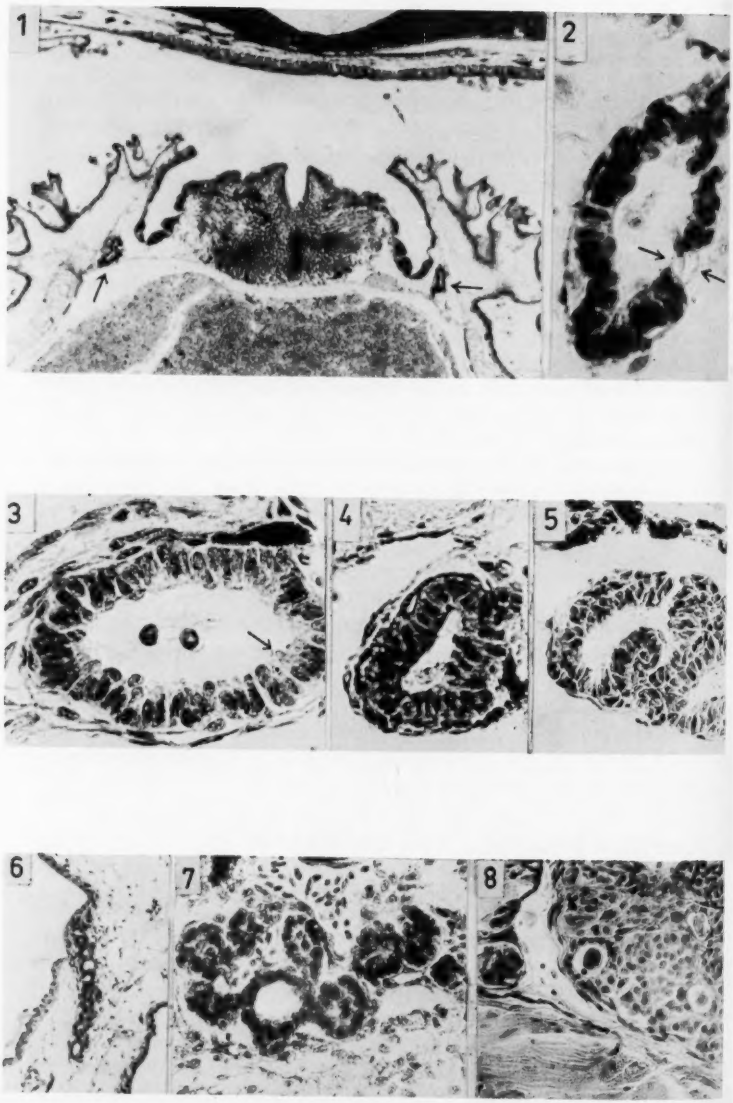
Epithelial cells interspersed among the follicles are called parafollicular cells. *Pelobates* is unique among the four species in the possession of such cells in the tadpole and adult stages (Fig. 6, 7), while these do not appear before the adult stage in *Bufo* (Fig. 8) and not at all in *Hyla* and *Rana*.

In the metamorphic period, the cell proliferation transforms the single-layered crowded epithelium of *Hyla*, *Rana* and *Bufo* into a pseudostratified layer. In *Pelobates*, the simple cuboidal epithelium of the coiled tube stage persists in the adult follicle. In the others, the epithelium begins to protrude into the lumen thus increasing the secreting surface area, that of *Hyla* remaining rather low, but that of *Rana* becoming considerably higher. Capillaries abut against the folds.

As metamorphosis proceeds, the *Hyla* follicle and the single or doubled follicle of *Rana* continue to enlarge; the follicular complexes of *Bufo* and *Pelobates* differentiate and multiply. The coagulum becomes more pronounced and uniform, especially in *Bufo* and *Pelobates*. It stains pink with eosin, but blue with Hotchkiss. The impression is gained that a heightened state of activity is setting in, if the criterion of such a state is taken, according to well-established principle, to be increased tissue growth and the provision of a richer blood supply. As long, however, as the function of the ultimobranchial body itself is unknown, this must remain in the nature of a conjecture.

In the adults, the ultimobranchial body is confined to the triangular space adjacent to the larynx, bounded dorsally by the region of the deepest fold of the pharyngeal floor, laterally and ventrally by the a. carotis and m. petrohyoideus and carotid body, and medially by the muscles of the larynx. The deepest fold of the pharynx floor represents the vestige of the sixth branchial arch. Each species has a preferred position even within this circumscribed area for the ulti-

Plate I.



Explanation of Figures

All sections were stained with Hematoxylin (Ehrlich) and Eosin.

1) *Rana* tadpole: total length 59 mm.; hindlimbs 5 mm. Diameter of the ultimobranchial body 75μ. Section 15μ; EF = 30 mm.; x60. The organ is to be seen at the base of the sixth branchial arch on both sides of the larynx. Both follicles are no more connected with the epithelium of the pharynx. Their wall is indented by capillaries. This stage is similar in *Hyla, Rana, Pelobates* and *Bufo*.

2) *Rana* tadpole: total length 34 mm. Diameter of the ultimobranchial body 104μ. Section 8μ; EF = 1.8 mm.; x750.
The organ shows a single layered epithelium with nuclei of different shapes. It is assumed, that the discontinuity of the epithelium is produced by the extrusion of a cell or a nucleus into the lumen. Adjacent to this place is a capillary. A small amount of coagulum is inside the lumen.

3) *Rana* tadpole: total length 48 mm; hindlimbs 19 mm; forelimbs 7 mm. Diameter of the ultimobranchial body 200μ.
Section 8μ ; EF = 4 mm. x510.
Typical follicle surrounded by a capsule with melanophores. Single layered epithelium with nuclei and plasmatic domes protruding into the lumen. Nuclei in the lumen are without any sign of degeneration.

4) *Rana* after metamorphosis. Diameter of the ultimobranchial body 260μ. Section 10μ; EF = 4 mm. x200. Pseudostratified epithelium of the bi-follicular organ with deep folds, accompanied by wide capillaries.

5) *Hyla* after metamorphosis. Diameter of ultimobranchial body 100μ; Section 10μ; EF = 4 mm. x510.
Pseudostratified epithelium of the single follicle of the organ. Three cells protrude into the lumen.

6) *Pelobates* tadpole: total length 36 mm.
Section 10μ ; EF = 16 mm. x160.
The ultimobranchial body forms a single layered, coiled tube, still connected with the pharynx epithelium. Beginning of the differentiation of follicles and parafollicular cells.

7) *Pelobates* at metamorphic climax. Diameter of the ultimobranchial body c. 270μ. Section 15μ; EF = 4 mm. x350.
Follicles with single-layered epithelium, parafollicular cells and wide capillaries.

8) *Bufo* after metamorphosis. Diameter of the ultimobranchial body of both sides c. 500μ. Section 10μ; EF = 4 mm. x330.
Many small follicles with mixed cuboidal-squamous epithelium. Clusters of parafollicular cells. Rich capillary network.

Comparison of the different features of the ultimobranchial body of the four species studied

	Hyla		Rana		Pelobates		Bufo	
	tadpole	adult	tadpole	adult	tadpole	adult	tadpole	adult
Form of the organ	round or ovoid	ovoid	round or ovoid	ovoid	coiled tube	ovoid	round or ovoid	ovoid
Diameter of organ	80 - 100 μ	200 - 300 μ	90 - 100 μ	200 - 350 μ		200 - 350 μ	100 μ	300-500 μ
Number of follicles	1	1	1	1 - 2	6 - 10	8 - 12	1	10 - 12
Surface of follicles	slightly indented	low folds	slightly indented	deep folds		smooth	indented	smooth
Epithelium of follicles	single layered, later pseudo-stratified	pseudo-stratified	single layered later pseudo-stratified	pseudo-stratified	single layered	single layered	single layered, later pseudo-stratified	single layered
Form of epithelial cells	different	more uniform	different	more uniform	rather uniform	cuboidal or squamous	rather uniform	cuboidal or squamous
Extrusion of cells	+	+	+	+	–	+	+	+
Coagulum	small, amorphous	small, amorphous, eosinophilic	small, amorphous	small, amorphous eosinophilic	small	conspicuous, round eosinophilic	small	conspicuous, round eosinophilic
Cells and cell fragments embedded in coagulum	+	+	+	+	+	+	+	+
Parafollicular cells	–	–	–	–	+	+	–	+
Location		inside, or near ventral wall of pharynx		near carotid body + a. carotis		near laryn-geal muscles		near laryn-geal muscles

mobranchial body, although intermediate cases exist. The definitive position in *Hyla* is the most dorsal of the four, directly latero-ventral to the deepest fold within or attached to the connective tissue of the pharynx floor above the triangular space. The organ of *Rana* is located at the lateral leg of the triangle, at its medial leg, those of both *Bufo* and *Pelobates*, which in this respect also are distinct from the other two species. The definitive position in *Hyla*, then, is the closest to the point of origin.

In the adult stages, aside from variations in the number of follicles, the species vary in the amount of secreting surface. The pseudostratified epithelium, which persists into the adult stages, is thrown into folds varying from low in *Hyla* to high in *Rana*, where the size of the lumen is reduced by the infoldings. In *Bufo*, in which the pseudostratified epithelium of the tadpole becomes simple squamoid-cuboidal postmetamorphically, and in *Pelobates*, which retains the squamoid-cuboidal form of its epithelium unchanged into adulthood, the free surface stays smooth, evidently because the need for secreting surface is met by the follicular multiplication.

The parafollicular cells in *Bufo* are somewhat larger than in *Pelobates*. The presence of these cells raises the question of their sourse and whether there exist corresponding cells in *Hyla* and *Rana*. The hypertrophy of the organ in the adult *Bufo* and *Pelobates*, therefore, may be due solely to the parafollicular cells. No conclusions are possible concerning this before the reconstruction of three-dimensional models to evaluate the extent of secretory surface. The application of differential staining methods may ascertain whether cells corresponding to parafollicular cells exist in *Hyla* and *Rana*, for pseudostratification of the epithelium is correlated with low numbers of follicles and absence of parafollicular cells, while cuboidal epithelium is associated with large numbers of follicles, and parafollicular cells.

That the pseudostratified epithelium of *Hyla* and *Rana* may contain cells corresponding to the parafollicular cells is supported by the fact that such cells are known to be present in Elasmobranches (*Spinax*) and Urodela, (Steinitz and Stone '54). Of course, the alternative possibility also exists that the ultimobranchial body of *Bufo* and *Pelobates* is only partly homologous to that of *Hyla* and *Rana*, that is, the parafollicular cells may infiltrate into the organ from some unknown extraneous source. Such a possibility would involve fundamental qualitative rather than merely quantitative differences displayed by the ultimobranchial body of the toads as compared to the frogs.

The presence of follicles containing a coagulum had led some authors (summarized in Lynn & Wachowsky '51) to consider the organ as a lateral thyroid gland capable of compensating the activities of the medial thyroid in time of need. In the author's opinion,

the appearance of the coagulum and of follicles in the two organs does not warrant this assumption. The coagulum of the ultimobranchial body never fills the lumen like the colloid of the thyroid. Besides, its blue colour with Hotchkiss' stain as compared to the red of the colloid on the same slide must be emphasized. In addition, the ultimobranchial body follicles with their domed pseudostratified epithelium, as seen in *Hyla* and *Rana*, bear no resemblance to thyroid follicles. Those with a simple epithelium (*Bufo* and *Pelobates*) differ from the thyroid in the constant size of follicles and cells, and in the absence of the phasic changes seen in the epithelium of the thyroid due to different activity. The difference is even more pronounced physiologically, for, as will be described in another study, the ultimobranchial body atrophies as a result of thyroxine excess, and hypertrophies in conjunction with hypothyroidism. Influences deleterious to the thyroid are found to favour the growth and proliferation of the ultimobranchial body. Obviously the two cannot be classed functionally as the same gland. The seasonal changes of the thyroid and their influence on the ultimobranchial body may contribute to a solution of this problem. Furthermore, the mammalian fetus still possesses the ultimobranchial body, identified on the basis of its location and a connection with the epithelium derived from the branchial arch, although it is poorly developed. It is embedded in the thyroid as a minute islet of tissue described in humans as a cyst by Getzowa ('07). Gorbman ('47) identified the organ in mice on the basis of a persisting ductus pharyngobranchialis IV, its follicles and its inability to take up radioactive I^{131}, in contrast to the thyroid: it, apparently, involutes, when the thyroid is growing.

Sterba ('50) and Saxén and Toivonon ('55) have observed, that the ultimobranchial body of *Xenopus laevis* degenerates during metamorphosis as the tail is absorbed. The four anurans described here differ markedly from *Xenopus* in retaining their ultimobranchial body without a trace of degeneration during tail resorption and for, at least, two years postmetamorphically, the oldest age examined. It was noticeable, that the more mature the animal, the more differentiated and characteristic of the species the ultimobranchial body became. It is not yet certain, whether the organ of the present anurans may not also degenerate at some later time up to and including sexual maturity. Further studies are needed to establish this point, as well as to permit the plotting of growth curves relating the size and weight of the organ at various stages to changes in total body weight.

It is difficult to surmise what the function of this structure may be. The fact that it degenerates after varying lengths of time in certain Urodela and *Xenopus*, led to the conclusion that it has no vital function (Saxén and Toivonen, '55).

Despite such statements, an array of findings necessitates a reinquiry as to whether the organ is truly functionless, and if not, what that function might be. Here, without attempting to answer the question, the absence of firmly-based alternative hypotheses makes it tempting to consider the organ in relation to the life habits of the various animals: the organ atrophies in *Xenopus,* which spends its entire life in the water, but is large and well-developed in *Bufo,* which leaves the water further behind than the other species and returns to it solely for reproductive purposes. A similar type of organ is also found in *Pelobates,* which spends the dry season underground. Is there any relationship between these behavioral differences and the activity of the respective ultimobranchial bodies?

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SUMMARY

The Ultimobranchial Body of the Anura of Israel
Histology, Glandular Tissue. Endocrinology, Interrelations.

The development and histology of the ultimobranchial bodies of *Hyla, arborea, Rana ridibunda, Pelobates syriacus* and *Bufo viridis* are compared. In the adult, the organ consists of one follicle in *Hyla* and of two in *Rana*, on both sides of the larynx. The epithelium is pseudostratified. In *Pelobates* and *Bufo* it consists of numerous small single-layered follicles and clusters of parafollicular cells.

The organ is assumed to be an endocrine gland because of its origin and structure.

The difference between the ultimobranchial body and the thyroid gland is discussed.

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FIRST RECORD OF A BROOD OF THE RED-SPOTTED GARTER SNAKE.—Wright and Wright (*Handbook of Snakes of the United States and Canada*, 1957: 844-5) stated that they knew of no published record of the young of *Thamnophis sirtalis concinnus* (Hallowell). Kenneth Gordon (The Amphibia and Reptilia of Oregon, 1939: 78) said that it was "perhaps the commonest snake in western Oregon from the coast to the Cascades and from the Columbia River to California." The northwestern Oregon coast and the Willamette River drainage area comprise the range of the Red-Spotted Garter Snake, one of the handsomest members of its genus in the

United States. Undoubtedly others have observed the birth and young of this form but according to the Wrights, the only juvenile preserved is in the Stanford University Collection (SU 4504) from the Alsea River near Alsea, Benton County, Oregon. This was taken August 28, 1899, by Allen and Burcheon, and measured 220 mm. t-l (total length). We report here on the birth of a brood of *T. s. concinnus*, and on the growth rate of one of the young for the first two years of its life. All measurements are in millimeters.

The parent female *concinnus*, measuring 673 + t-l (tip of tail missing), was collected by Eric Skov at Corvallis, Oregon, early in May, 1957. She gave birth unobserved, during the 24 hours between noon of July 27 and 28, to ten living young. No mating had taken place in captivity; she had been isolated from males during the entire time. Total lengths of the ten young garter snakes ranged from 213-248, with a mean at 230. Most representative lengths were 216, 235, and 248 (two each). Two weeks later half of the baby snakes ate small live frogs and toads. The remainder began eating later. Their first shedding occurred during the period between 27 and 33 days after birth. The growth rate of the most aggressive feeder (one of the largest at birth) was recorded by measuring the snake immediately after each skin casting. It cast its skin nine times during the first year at intervals ranging from 18-74 days. Long intervals between sheddings (53, 66 and 74 days) occurred between mid-September and the end of March, although the snake was kept at a mean temperature of approximately 72° F., and it ate and grew as usual. During the warmer (and more humid) months ecdysis occurred about every 3½-4 weeks. Items of diet taken during the first year included specimens of various species of *Ambystoma, Desmognathus, Plethodon* and *Eurycea* (except *Eurycea l. longicauda*, which was consistently refused), small frogs and toads, clams, fish, earthworms, pieces of fowl meat, gizzard, heart and liver, and lamb's liver.

During the snake's second year of life, it shed six times at intervals of from 36-126 days, again the shorter intervals being during the summer months. Although in increased its birth length 2.2 times the first year, it had only increased it 2.4 times by the end of the second year. At the age of two it measured 597 t-l.

Sexual dimorphism in tail length and number of subcaudals is to be expected in natricine snakes. This individual, which measured 248 mm. at birth, is a male, and the tail is approximately 28% of the length. Several of the litter mates were checked at the age of one year for sex and proportionate tail length. Those with tails roughly 20-25% of the total length were females, those with longer tails were males. The snake on which details are presented above, grew from 248 to 546 in its first year, had fully developed knobs on the dorsal keels in the anal region, and possibly had reached sexual maturity by

its first spring. At that time its length was about 457. We feel that the indirect evidence of its fully developed knobbed anal keels and rapid first-year growth, leveling off during the second year, tends to confirm completion of sexual maturity during its first year of life. Another male litter mate, which measured only 380 at one year, had only weakly knobbed scales at that time.

We wish to thank Mr. Roger Conant, Curator of Reptiles, the Philadelphia Zoo, for reading and criticizing the manuscript. A word of appreciation is due both Gil and Neil J. Bailer of Philadelphia for giving us the newborn litter of *concinnus* on which this report is based.—*Norma and Barry Rothman, 7036 Rising Sun Avenue, Philadelphia 11, Penna.*

CAPTIVE BOXTURTLES, *TERRAPENE COAHUILA*.—Five specimens were collected in late August, 1959, from a marshy area 5 mi. W. Cuatro Ciénegas, Coahuila, Mexico. They were caught in grass 8-14 inches in height with the surrounding water about 2-8 inches deep. Since no information on habits has appeared in the literature subsequent to the original description (Schmidt and Owens, Field Mus. Nat. Hist., 29(6) 1944: 101-103) these were kept alive at the University of Illinois where various notes were made on their habits in captivity.

Three of the five were observed to feed on young fish (bluegill sunfish) which were given them dead on a dry surface, and alive in a shallow pan 3 inches in depth. These turtles were also placed singly in a 10 gallon (water depth 10 inches) aquarium containing approximately 14 small bluegills but no attempt was made to catch the fish. The clear glass seemed to confuse the turtles, and their main efforts were directed in trying to get out. In the 3 inch pan they were very deliberate in their first strike at the fish. However, if this attempt failed they would haphazardly try to catch the fish, sometimes succeeding. One of the turtles captured and ate a fish below the water surface. Roaches were also caught and eaten after being placed on a dry surface in the enclosure with the turtles.

This species of *Terrapene* seems more agile in water than any other species personally observed (*T. ornata* and *T. carolina*). They are capable of rapid swimming movements, and are not hesitant to submerge. When placed in a large sink (25 inches x 45 inches) they often would move toward running water, *i.e.*, water running into a shallow pan would often cause two or three of them to "investigate."

The above notes seem to be in complete agreement with their semi-aquatic habits in nature as suggested by Williams, Smith and Chrapliwy (in press). Thanks are due Mike Duever and Phil Porzel for their indispensable aid in the field.—*Kenneth L. Williams, Department Zoology, and Museum of Natural History, University of Illinois, Urbana.*

A New Subspecies of *Coniophanes fissidens* and Notes on Central American Amphibians and Reptiles

By SHERMAN A. MINTON AND HOBART M. SMITH

From June 30 to August 24, 1957, the senior author traveled in Central America as a China Medical Board Fellow in Tropical Medicine. The fellowship afforded opportunity for collecting and observing amphibians and reptiles; 45 species and subspecies were collected and preserved. Most have been retained in the personal collection of the senior author (SAM); some duplicates have been deposited in the University of Michigan Museum of Zoology (UMMZ), and in the Illinois Natural History Survey in Urbana (INHS). The type of the new form has been deposited in the University of Illinois Museum of Natural History (UIMNH), and the paratypes in the Kansas University Museum of Natural History (KUMNH).

The localities represented are in the republics of Costa Rica, El Salvador and Guatemala (C. R., E. S. and Guat. hereinafter). In order to avoid repetition the collecting sites are allocated as: C. R.: San José, Moravia, and Escazú, *San José Prov.*; Ojo de Agua near Heredia, *Heredia Prov.;* Paraiso, Ujarras Ruins 3 mi. S Paraiso, La Suiza, *Cartago Prov.;* Palmar, Golfito, Volcán de Buenos Aires, *Puntarenas Prov.* E. S.· San Salvador, *San Salvador;* Finca San Nicolas de Lempa, *Usulután.* Guat.: Antigua, *Sacatepequez;* Lake Atitlán and Chichicastenango, *Sololá;* Finca Pana Habal near Yepocapa, *Chimaltenango;* Los Ilusiones 13 km. S Escuintla, *Escuintla.*

Of interest primarily for locality record are: *Bufo coccifer* and *Smilisca baudini,* San Salvador and Finca San Nicolas de Lempa, E. S.; *Bufo coccifer,* Moravia, C. R.; *Eleutherodactylus ranoides,* Golfito, C. R.; *E. rugulosus,* Finca Pana Habal, Guat.; *Leptodactylus pentadactylus dengleri, L. quadrivittatus* and *Hyla p. phaeota,* ½ mi. E Volcán de Buenos Aires, C. R.; *Hyla staufferi,* San Salvador, E. S.; *Rana pipiens,* Lake Atitlán Guat.; *R. warshewitschi,* San José, C. R.; *Anolis c. crassulus,* Chichicastenango, Guat.; *A. cupreus,* Ujarras Ruins, C. R.; *A. intermedius,* nr. Paraiso, and San José, C. R.; *A. polylepis,* Golfito, C. R.; *Basiliscus basiliscus,* Cone Finca 1 mi. E Volcán de Buenos Aires, C. R.; *Sceloporus malachiticus acanthinus,* Los Ilusiones, Guat.; *S. m. smaragdinus,* Antigua, Guat.; *S. squamosus,* Finca San Nicolas de Lempa, E. S.; *Coniophanes f. fissidens,* Finca Pana Habal, Guat.; *Geophis hoffmani,* Ujarras Ruins and Moravia, C. R.; *Erythrolamprus bizonus,* 1 mi. E Volcán de Buenos Aires, C. R.; *Leptophis depressirostris,* 1 mi. SE La Suiza, C. R.; *Trimetopon pliolepis,* Mts. above Escazú, 7000 ft., C. R.

The following we regard as noteworthy.

Eupemphix pustulosa (Cope). San Salvador. Calling Aug. 6,

emitting two very dissimilar calls. Some were found in amplexus in a few cubic centimeters of water in a gutter with many tadpoles apparently of this species. Foam masses containing eggs were found in a shallow pool Aug. 10.

Leptodactylus insularum Barbour. One; Max Cone Finca, 1 mi. E Volcán de Buenos Aires, C. R. Observed plentifully at night. After a heavy rain Aug. 21, they were widespread. *L. pentadactylus* also was plentiful, but always close to the numerous small streams.

The name *insularum* 1906 appears to be the earliest for this species. The name *bolivianus* Boulenger (1898, Ann. Mus. Civ. Stor. Nat. Genova, (2) 19: 131-132), applied to it by Dunn, Taylor, Breder and others, can scarcely belong here since Boulenger states that in *bolivianus* (of which he had several) the males have "a compressed oval tubercle, covered with a black horny sheath, on the inner side of the inner finger." He separated *bolivianus* from *ocellatus* primarily on this character and having only two folds on sides of body, whereas *ocellatus* has two tubercles and 3 or more rows of short folds on sides of body. *L. bolivianus auctorum* of Central America has two tubercles; neither is compressed and only the tips bear horny spines.

All pertinent names other than *insularum* and *bolivianus* appear to be based on species lacking dorsolateral folds, or that have more than two dorsolateral folds. Barbour's description (1906, Bull. Mus. Comp. Zool., 46: 228-9, type locality Saboga=Taboga Isl., Bay of Panama) fits the Cone Finca specimen as well as Taylor's description (1954, Univ. Kans. Sci. Bull., 36: 617-620, fig. 6) although the striped pattern, shown both by the Cone Finca specimen and Taylor's figure, is not described. Dunn (1931, Occ. Papers Boston Soc. Nat. Hist., 5: 418) emphasizes that Panamanian "*bolivianus*" are not striped and have three folds on each side; apparently these statements are lapsi. The C. R. population may be racially distinct from nominate *insularum*, but series sufficient for solving the problem are not at hand. Possibly *insularum* will prove to be a subspecies of *ocellatus*, to which it clearly is related, but from which it differs primarily in having more distinct and fewer folds on back (as through coalescence), and a more distinctly striped pattern with characters notably susceptible to geographic variation.

Shreve (1947, Bull. Mus. Comp. Zool., 99: 535) and Stebbins and Hendrickson (1959, Univ. Calif. Publ. Zool., 56: 529) have used the name *bolivianus* for Venezuelan and Colombian material respectively, emphasizing that the referred specimens have two tubercles on the pollex instead of one as described by Boulenger. All three authors assumed, as Stebbins, Hendrickson and others have attempted to justify, that Boulenger's specimens lacked one tubercle because of unusual variation or loss in preservation. How-

ever, (1) Boulenger had *several* males, each with one tubercle—a fact that very strongly reduces the probability of mutilation or variation; (2) Boulenger described the tubercles as compressed, whereas they are not compressed in any specimens described or examined of *insularum sensu lato;* (3) Boulenger described the whole tubercle as covered with horny sheath, whereas only the tip is horny in *insularum sensu lato;* and (4) the type locality in Bolivia is distant from the areas of record of *bolivianus auctorum* of Central America and northern South America. Present evidence justifies restriction of the name *bolivianus* to the southern populations near the type locality and use of *insularum* as the next available name for the northern *bolivianus auctorum* of Central America and northern South America.

Cochranella fleishmanni (Boettger). Two, Parque Bolivar, San José, C. R. Color notes in life describe this frog as pale green with yellowish green spots on dorsum, yellowish edge of upper eyelid; ventral skin actually transparent, viscera encased in glistening white membrane. One found clinging to a lamp post, another calling from a leaf 7 ft. above the ground. Call, a single note suggestive of that of *Hyla crucifer;* heard throughout July in Parque Bolivar, never before dusk, always from trees along swift streams at heights of 5-10 ft.; very difficult to trace.

Oedipina uniformis Keferstein. One adult, Ujarras Ruins, C. R., Aug. 4, under rubble; more active and sinuous in movements than the Escazú specimens of *pacificensis,* and darker, approximating the ground color of *Plethodon j. jordani.* Under rotting banana stalks nearby were several clusters of 40-50 oval amphibian eggs connected by mucoid cables.

Oedipina pacificensis Taylor. Three (two in UMMZ), July 4, under logs at edge of a wet meadow near Escazú, C. R. Their movements were sluggish and stiff. The dorsal color in life was dull, similar to the leadback phase of *Plethodon cinereus.* After two years in preservative no postocular light spots are evident, as Taylor (1952, Univ. Kans. Sci. Bull., 37: 777) states is true in the type ("dimly discernible in preserved specimen"), but the extensive light edging of upper and lower eyelids is clear. The digits are somewhat different from the figures of the type, with shorter median fingers and less distinct 1st and 5th toes; 20 instead of 19 costal grooves; these deviations are assumed to fall within the normal variation of the species.

Dermophis mexicanus glandulosus Taylor. One under a pile of logs 1 mi. E Volcán de Buenos Aires, C. R. It has 101 primaries, 36 incomplete secondaries; body width about 9.5 mm., length 250 mm. (ratio width to length 26). It agrees with the C. R. *Gymnopis mexicana gracilior* of Dunn (1942, Bull. Mus. Comp. Zool., 91: 462-3, 477-9), who records 3 from Panama with 68-78 secondaries,

and 1 from C. R. with 32 secondaries. He noted the geographic correlation of count differences which our specimen bears out. On this basis a C. R. subspecies of *mexicanus* appears valid. We apply the name *Dermophis glandulosus* Taylor to it with some misgivings. Taylor's type (1955, Univ. Kans. Sci. Bull., 37: 501-10) agrees with *gracilior* in Dunn's characters, but like the other two C. R. examples has fewer secondaries (49) than the Panamanian examples. It differs from *gracilior* in having a dorsolateral light stripe not evident in our specimen nor described in other works, and in having 22 complete secondary rings. Our specimen has no secondary rings complete, and it may be inferred that Dunn's C. R. example also has none complete, whereas the 3 Panamanian specimens have 8-10 complete. Despite these unique characters in the type of *glandulosus*, we are more reluctant to name the C. R. *mexicanus* as new (and separate also from *glandulosus*), than we are to assume, for the present, that *glandulosus* is based upon a variant of the C. R. *mexicanus* related to *gracilior*.

The type of *glandulosus* has 95 primaries if the two nuchals are counted, as presumably Dunn did; thus the type has 95 rings by Dunn's counting, a figure within the range given by Dunn for *gracilior*. If the count were 93 by his system (as it is by Taylor's) it would be two less than previously recorded for the subspecies and the genus.

Gymnopis m. multiplicata Peters. One adult found in the same pile of logs as the *Dermophis*. It has 130 primaries and 110 secondaries of which 16 are complete.

Basiliscus galeritus Dumeril. One juvenile, Golfito, C. R., agrees with Taylor's description (*op. cit.*, 1956: 177-179), based upon three juveniles also from Golfito. These apparently are the only records from Central America. Like Taylor, we doubt the actual conspecificity of C. R. and South American populations. *B. basiliscus* of comparable size has very different dorsal and caudal crests.

Sceloporus malachiticus malachiticus Cope. Specimens collected (UMMZ, INHS) or observed were between 3000 and 7000 ft. at San José, near Escazú, and near Paraiso, C. R., and at Lago Coatepeque, E. S. Two found in San José feigned death soon after capture. On July 25 in San José a male was observed approaching a large female basking on the trunk of a dead tree. He bobbed vigorously, inflated the body and gular pouch, and assumed a humpbacked pose. The female remained indifferent until the male nipped the side of her neck. She then ran away, the male following.

Ameiva quadrilineata (Hallowell). Numerous specimens (UMMZ, INHS) near Palmar and Volcán de Buenos Aires, C. R. Abundant in open grassy places such as railroad embankments and the edges of air strips; also in banana groves and in fairly dense second growth jungle, but less common.

Scincella assata assata (Cope). Finca Pana Habal, Guat. One adult, tail red in life; found on a moist hillside planted in bananas.

The apparently proper termination for the specific name, when referred to *Scincella*, is *assata*, not *assatus* or *assatum* as used in some works. Cope did not discuss the etymology of the name, which may be derived from the past participle of *assare*, to roast. The apparent allusion is to the reddish-brown, "roasted" appearance of preserved specimens. As a past participle the word is treated as an adjective, which must agree in number and gender with the generic name, in turn obviously feminine and not neuter.

Taylor (1956, Univ. Kans. Sci. Bull., 38: 283-4) rejected *Scincella* for the species *cherriei*, which he placed in *Leiolopisma*, because of its deviation from the type species *laterale*, in (1) absence of nuchal scales, (2) presence of an undivided frontoparietal, (3) a divided disc on lower eyelid, and (4) no pterygoid teeth. The third point is the most significant, but we find that Mexican and Guat. *cherriei* have an undivided disc on the lower eyelid; the corneal covering slips off intact without sutures or grooves. Possibly C. R. examples are different in this respect from more northern ones, but if not, the bases for rejection of *Scincella* are left very weak, for none of the other characters is particularly sound. We find no pterygoid teeth in *laterale*, *assata* or *cherriei*, and variability of nuchals is known in *assata* and *gemmingeri*. The divided or undivided frontoparietal is the only reasonably reliable character, of the 4 cited by Taylor, that might serve to differentiate the *laterale* and *assata* sections of *Scincella*. Even this has been shown to be subject to variations (Mittleman, 1950, Herpetologica, 6: 19-20). To this character we have added another, unfortunately with a misprint (1950, Bull. U. S. Nat. Mus., 199: 156), that seemingly holds equally as well as the frontoparietal character, and separates the same two series of species: many of the median subcaudals overlap two scales on each side in the *laterale* section, whereas all overlap but one laterally in the *assata* section. This difference hinges upon the larger size in *laterale* of the median subcaudals. We have not examined Eastern Hemisphere *Scincella*. Whether this character would provide a sound basis for subdivision of *Scincella*, supporting the frontoparietal character, is not known.

Mabuya brachypodus Taylor. Ojo de Agua, C. R., several seen in small rock pile in open field, some considerably larger than the one caught. This is the only place on the C. R. Mesita Central where scincid lizards were seen. A 54 mm. s-v male agrees with *brachypodus* in pattern (Taylor, *op. cit.*, 1956: 309), except for having minute black spots representing a dorsolateral dark line along medial edge of dorsolateral light line. Scales from parietals to above vent 56 (59-61 in C. R. *brachypodus*, 53-55 in ♂ and 57-58 in ♀ *alliacea*), 5th supralabial below eye (5th in *brachypodus*, 6th in

alliacea), supranasals narrowly separated, axillary pit well defined, limbs barely overlapping (foreleg 13, hind leg 17, axilla-groin 29 mm.). Presumably this feature is correlated with juveniles which have proportionately longer limbs. The scale rows are more numerous (30) than in *alliacea* (26-29), the only other species with which this might be confused. Other characters described by Webb (1958, Univ. Kans. Sci. Bull., 38: 1310) agree with expected variation in *brachypodus*.

Although Taylor (1956, *op. cit.*: 310) suggests a range limited to the Pacific coast, the vertical range is extensive; the Mesita Central is 5000 ft. and Webb reports (*op. cit.*: 1311) the species from localities (*e.g.* Uruapan) of about the same elevation on the Pacific slopes of the Mexican plateau.

Mabuya unimarginata Cope. Common (UMMZ, INHS) on fence posts a foot or two above ground, or under rocks and other cover, at Max Cone Finca, 1 mi. E Volcán de Buenos Aires, C. R. The specimen taken has almost the same pattern as Taylor's (*op. cit.*, 1956: 304) figure shows; it also agrees with the diagnosis in having 30 scale rows and frontonasal separated from rostral; two chinshields touch labials on one side, one on the other.

Coniophanes fissidens obsoletus subsp. nov.

Holotype. UIMNH 46573, an adult male found under a log at edge of a citrus grove on the Max Cone Finca, 1 mi. E Volcán de Buenos Aires, Costa Rica. It contained a *Leptodactylus*.

Paratypes. KUMNH 30976-9, 34834, farm of Inter-American Inst. Agri., Turrialba, Costa Rica.

Diagnosis. A geographic race of *Coniophanes fissidens* lacking large dark spots near ends of ventrals; 21 rows at midbody; no paravertebral spots; no white dorsolateral streak on nape; ventrals usually 121 or more in males (75%), 126 or more in females (100%).

Description of holotype. Rows 21-17; ventrals 114; tail incomplete; supralabials 8-8, infralabials 10-10, preoculars 1-1, postoculars 2-2, temporals 1-2; s-v 309 mm., tail 98+ mm.; supranals keeled.

Dorsal pattern dim, basically as shown in Taylor, 1954 (*op. cit.*: 759); vertebral marks and lateral dark zone scarcely evident, latter involving lower 5 rows where 21 rows occur, lower 4 at rear of body; medial edge of lateral dark zone sharply defined only on tail; venter with numerous subequal small black dots, those near ends of ventrals not enlarged.

Remarks. C. R. examples of this species have been referred to *punctigularis* by Taylor (1951, *op. cit.*: 142-3, and 1954, *op. cit.*: 759-60), but the entire southern population, presumably embracing representatives from South America also, differs from *punctigularis* in lacking the distinctive paravertebral dark spots and to a lesser degree in having fewer ventrals. It also differs from *f. dispersus* and *f. proterops* in having 21 instead of usually 19 rows. It most re-

sembles *f. fissidens* of Mexico and Guat. (type locality "Mexico," restricted to San Andres Tuxtla, Ver.), but lacks the prominent row of relatively large dark spots at the ends of ventrals (an apparently constant feature in *f. fissidens*), lacks the prominent white dorsolateral light on nape, and has fewer ventrals. In 10 C. R.-Panama males the ventrals vary from 114 to 119, whereas they are 117-126 in 5 *f. fissidens* (only one with less than 121); in 15 C. R.-P. females, ventrals 117-127 (only 2 with more than 125), 126-130 in 8 *f. fissidens*. Present records do not indicate area of intergradation of these two subspecies, but the type locality (restricted) of *f. fissidens* is at the extreme northern edge of its range.

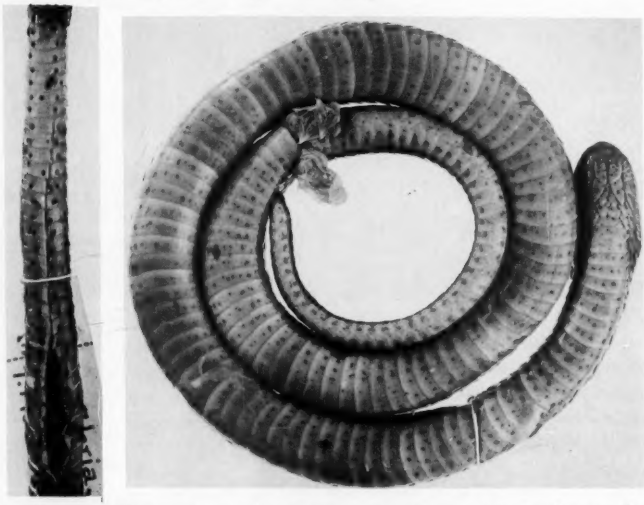

Fig. 1. Comparison of pattern on venter on *Coniophanes fissidens obsoletus* (right, type) and *C. f. fissidens* (left, UIMNH 3777, La Gloria, Oax., Mex., 3-inch section).

Dryadophis sanguiventris Taylor. Palmar, C. R., 1 subadult female; 186 ventrals, divided anal, 98 caudals; 930 mm., tail 196 mm. Mostly olive-brown above, with dim striped pattern on sides of anterior third of body, fading posteriorly; a dark line down adjacent edges of 1st row and ventrals; a line slightly lighter than ground color on adjacent parts of rows 1 and 2; a dark line on upper edge of 2, another on upper edge of 5, and between these the ground color slightly darker than on dorsum; a dark postocular line, lost on nape; a dark loreal line; edges of scales of lower jaw dark; belly immaculate white except upturned outer edges of ventrals, where ground color of equal intensity to that of dorsum ends sharply;

small flecks down midline of subcaudal surface. In life the belly was a "peach" color.

The snake was caught in a banana plantation in the daytime, and bit viciously. Its local name is "sabanera," also applied to some other slender, active snakes.

The concept of coexistence of *sanguiventris* and *melanolomus alternatus* is based on observation in life by Taylor of both red-bellied and yellow-bellied examples and the conclusion that these represent two separate Mendelian populations. Since no differences in scutellation are involved, if this concept is correct it is unique in the genus; no other species fails to differ in scutellation from its congeners. Color species are rare among snakes. This C. R. specimen has been compared with others from Panamá, and even with the loss of the reddish ventral color the two lots are readily separable by the sharp demarcation of the dark ground color and the light ventral color at the lateral angles of the ventrals. This specimen is perhaps somewhat intermediate in color between the described yellow and red examples, since its belly was peach color: *sanguiventris* may prove to be a color variant of *alternatus*, but proof should come in the discovery of intermediates in a single population, or both types in single broods.

Imantodes cenchoa semifasciatus Cope. One Golfito, C. R., found at night in edge of jungle near stream in tree, crawling slowly upward.

See p. 232 >

Leptodeira annulata rhombifera Günther. One adult found by Emil Kotcher on a bush near the airport at Golfito, C. R. It disgorged an adult *Leptodactylus insularum*. Dr. Bernard Bechtel kept the snake alive several months in the United States. It did not feed voluntarily, but drank copiously until the body was distended. A bite from it caused more pain and inflammation than is usual with bites by North American colubrids of similar size.

Ninia maculata maculata (Peters) x *N. m. tessellata* Cope. One was found under bark in Moravia, a suburb of San José, C. R., and seems to bear out Burger's (1954, Univ. Kans. Sci. Bull., 36: 652-53) suggestion that *maculata* and *tessellata* intergrade and are intraspecific subspecies. It has the ventrals (143 ♀), caudals (50), belly pattern and bold contrast in dorsal pattern of *maculata*, but an intermediate number of dorsal dark bands (38-40, rear bands scarcely indicated) narrower than in typical *m. maculata*.

Pliocercus euryzonus dimidiatus Cope. Ujarras Ruins, C. R. One adult female, 2-2 preoculars, 8-9 supralabials with 4-5/5-6 entering orbit, 141 ventrals, 18 black rings on body and 8 on tail, light rings 1½-2 scales long and dark-flecked; light rings "orange," but kodachromes of the living snake show a color closer to magenta or rose lake, not strong red or lavender. It has the supralabial characters of *annellatus* on one side and on the other those of *dimidiatus*

and has the preoculars (2) of *annellatus* on both sides. This leaves *annellatus* with only one distinctive feature, the more numerous (22) black rings on body. Since *dimidiatus* has a range of 14-19, overlap is possible. The light rings on this specimen are intermediate in color between the red rings of *dimidiatus* and *annellatus* and the white to light lavender rings of *arubricus*. All C. R. specimens seem distinct, at least subspecifically, from the narrow-banded *e. eury-zonus* of Panamá and South America.

Xenodon rabdocephalus rabdocephalus (Wied). One in the collection of the Hospital at San Juán de Dios, C. R., presumably of local origin, was presented by Dr. Alfonso Trejos. The pattern is extremely variable. The hourglass-shaped dark crossbands on posterior part of body are indistinct laterally and are subdivided at middorsum medially so as to give the appearance of having a median series of dorsal blotches twice as numerous as the true hourglass-shaped marks. Pattern is of relatively little value for diagnosis in this genus.

The common use of *colubrinus* for this species stems from Boulenger (1894, Cat. Sn. Brit. Mus., 2: 144-151) who regarded Wied's *Coluber rabdocephalus* 1825 as a composite; Boulenger placed part with *Ophis merremi* Wagler 1824, and part with *Xenodon colubrinus* Günther 1858, presumably implying restriction of the name *rabdocephalus* to the part synonymous with *merremi*. The original description of *rabdocephalus* clearly states that the anal is entire in both the "typical" form and in at least one of the two varieties, whereas that of *merremi* is divided. If the choice lies between the forms commonly called *merremi* and *colubrinus*, as is commonly agreed, the name *rabdocephalus* must be synonymous with *colubrinus*. Since *rabdocephalus* is the older name it takes precedence over *colubrinus*.

The form in Mexico and adjacent Central America (*X. r. mexicanus*) differs from more southern examples only in ventral count. It is likely that morphological intermediates exist in intermediate areas, and therefore we follow Schmidt (1941, Publ. Field Mus. Nat. Hist., Zool. Ser., 22: 501) in regarding these two forms as subspecies.

Micrurus n. nigrocinctus (Girard). One mature male from ½ mi. SE Palmar, C. R.; 216 ventrals, 47 caudals, 19-20 rings on body; red rings on venter not spotted; yellow rings 1½ scales long; all dorsal scales in red zone black-tipped; black on head cap extending posteriorly along interparietal suture to end of parietals. It was turned up by workers digging in a banana grove.

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Observations on Movements and Behavior of *Bufo fowleri* in Residential Areas

By Denzel E. Ferguson

Of the five species of toads found in Mississippi, Fowler's toad is the most widely distributed and most common inhabitant of lawns and gardens. In Mississippi towns, during the summer, large numbers of these toads nightly congregate under streetlights where they feed on insects attracted to the lights. Fatalities run high on heavily traveled streets, at least six being recorded at one light. This toad population existing under unusual conditions poses an interesting problem for study. In order to learn something of their behavior and movements, a series of 15 streetlights was selected, which encloses a residential area of several city blocks. The area consists principally of large yards, the dwellings being widely spaced, with an abundance of shrubbery, gardens and well-kept lawns. Two small goldfish ponds are located nearby, one at each end of the area. These are known to be used as breeding sites by *fowleri*.

The lights were visited nightly or as often as possible, usually between 8 and 11 p.m., but as early as 7:30 p.m. and as late as 2 a.m. All toads found, including a few found between lights, were captured, measured, marked by toe-clipping and released. This information plus air and soil temperatures, weather conditions, insect abundance, amount of dew and time of observation were recorded. Between ¾ and 1½ hours were usually required to visit the series of lights.

Results and Conclusions

The lights were inspected on 134 nights, including 53 times in 1957 between June 12 and October 25. In 1958, 81 nightly trips were made between May 14 and September 9. A total of 145 toads was marked at an average rate of 1.08 per night (0-5 extremes). A grand total of 245 captures was made or an average of 1.82 per night (0-9 extremes). One hundred marked toads were recaptured. Only 9 of those recaptured had moved to another light, and in all cases to an adjacent light, indicating a sedentary nature. Two of the nine subsequently returned to the original light. The largest number of recaptures for an individual toad was 14 during two summers, always under the same light. One other was captured 10 times in 1958, another 8 in 1957, and two others on 7 occasions in 1958.

An individual adult toad tends to remain in the vicinity of a single light throughout the summer. Young toads, however, frequently appear only once as transients dispersing from the ponds and may leave the study area, the majority of them never being recaptured again. Of the 90 toads marked in 1957, only one was recaptured in 1958. It was found under the same light where it was

Summary of Capture Data

Number of toads captured per night:

Number:	0	1	2	3	4	5	6	7	8	9
Frequency:	35	29	36	18	6	2	5	0	2	1

Number of toads captured per light:

Light Number:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1957 (53 trips)	3	19	20	18	17	1	13	2	4	9	4	6	2	5	19
													Total:		140
1958 (81 trips)	7	0	2	4	7	3	15	0	8	14	9	2	3	2	29
													Total:		105
													Grand Total:		245

originally captured. Thus, those marked in 1957 were either killed or, more likely, they failed to return to their previous summer areas upon leaving the breeding ponds in 1958.

The number of toads visiting lights tends to increase as the summer progresses due to population increase and also, probably, due to a learned response to a readily available source of food. A peak of activity occurs in the early evening when both adults and young appear. Later in the evening, the young tend to disappear leaving adults which may remain out until nearly dawn. If a street light burns out and is not quickly replaced, it is no longer frequented, and some individuals may move to an adjacent light. If a burned-out light is not quickly replaced early in the season, when the adults are selecting summer home sites, the light involved may have a subnormal population for the remainder of the summer.

In the small ponds previously mentioned, recently metamorphosed toads average about 7.2 mm. in length. Metamorphosing toads rest at the edge of the concrete pools with their tails in the water, the tail apparently serving as a sort of wick in keeping them moist. The young toads are at first diurnal, and the smallest one found under a light was 32 mm., the majority being 38-45 mm. at the time they start to frequent lights. A markedly prolonged breeding season is exhibited in the area. On March 13, 1957, I visited a breeding pond near the study area where an estimated 1500 males were calling. In 1958 toads were heard calling nearly every week from their first appearance about April 1 into August. New tadpoles were found on August 1. In 1959, the first chorus of the season was heard on March 26. The appearance of 35-45 mm. toads at all times throughout the summer also illustrates the long breeding season.

Neither soil nor air temperature has any apparent effect on activity, unless extreme. Dew, usually present in fair quantities, apparently serves to replenish body water as the toads hop through moist grass to and from the lights. The availability of active insects was not obviously correlated with appearance of toads at lights. A marked absence of adults was noted during times of full moon

accompanied by clear skies. Young appeared at these times but in lesser numbers. Maximum toad activity occurred on rainy nights following several days without precipitation. The best night (9 captures) was July 17, just after a severe thunderstorm. The preferred nocturnal habitat was found to be in the vicinity of lights with well-clipped lawns, abundant shrubbery, and flower gardens for diurnal retreats. Bare soil and tall grass areas were avoided.

Natural predation in the area studied is probably negligible due to the human population controlling toad predators such as hognosed snakes. Mortality seems attributable to automobiles, children, and winter exposure. A number of marked and unmarked *Bufo* were found DOR during the course of the study. (It is believed that the toads become conditioned as the summer progresses.) They were observed to be frightened by passing cars in June, but by September, frequently remained in the street, while cars passed over or near them. Winter losses were apparently high in 1957-58, it being one of the harshest winters in recent years, with unusually cold weather and high rainfall. The entire population appeared to be down in 1958 as compared to 1957. Thus 140 toads were captured in 53 days in 1957 compared to only 105 in 81 days in 1958. This is especially obvious when the records for lights Nos. 2-5 are compared for the two years (74 in 1957, only 13 in 1958). The fact that some of the lights were not repopulated in 1958 would tend to substantiate the contention that *fowerli* is very sedentary during the summer.

In addition to *Bufo fowleri,* the following species of herps were recorded under lights at night: 9 *Gastrophryne carolinensis,* 4 *Rana catesbeiana,* 2 *Pseudemys scripta,* 1 *Pseudacris nigrita,* 1 *Rana areolata,* 1 *Natrix rhombifera* (dead), and 1 *Haldea striatula.* Predaceous arthropods such as carabids, cicindellids and spiders were always present in large numbers, apparently feeding on the insect fauna attracted to the lights.

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NEW NAME FOR A CHIHUAHUA LIZARD.—Dr. Hobart M. Smith has pointed out that the recently proposed subspecies name *Sceloporus nelsoni coeruleus* Tanner and Robison (Tanner and Robison 1960. Great Basin Nat. 19:79.) is a secondary homonym of *Sceloporus ornata caeruleus* Smith (Smith, Copiea 1836:227-230). As a replacement for the homonym *coeruleus* we propose the name *Sceloporus nelsoni barrancorum.—Wilmer W. Tanner* and *W. Gerald Robison, Jr., Brigham Young University, Provo, Utah.*

Nasal Obstruction During the Pre-Molt Period in *Natrix*

By HARRY S. MCDONALD

Although there is a considerable body of literature dealing with ecdysis in snakes (Brown 1956, Herpetologica, 12:313-20) the greater part of it is concerned with shedding frequency. Relatively little attention has been focused on mechanical shedding or its initiation. For this reason the observations reported here may be of interest.

A captive *Natrix sipedon confluens*, ready to shed, was seen lifting the anterior head shields of the slough by air blown through the nostrils. Initially, only the rostral, prefrontals, frontal, and nasals were involved; however, the inflation was repeated frequently and thirty minutes later the parietals, spectacles, and anterior upper labials had also been loosened. The snake then freed its snout by rubbing against the side of the terrarium while the slough was inflated. The upper and lower labials were abducted and the jaws were gaped widely several times. Within the next thirty minutes the entire dorsal surface of the head was cleared and the specimen was resting quietly. These observations were made during late afternoon and by the following morning, ecdysis had been completed. The slough was examined under a dissecting microscope and there was no obvious abnormality in the nasal region. The epidermis in snakes extends into each nostril as a short funnel, and in this slough the funnels were merely flattened with the inner surfaces lightly adherent. Several fresh sloughs were examined and the same condition was found in each.

Other specimens in the terrarium were nearing shedding and these were observed at short intervals throughout the daytime and evening hours to see if the phenomenon would recur. Less than a week later a second specimen was seen blowing air under the head plates. This ballooning of the slough was repeated more than a dozen times during the hour before the rostral was rubbed free. The specimen had been in the laboratory over a month prior to the observation and it continued in apparent good health until sacrificed two months later.

Nasal obstruction without lifting of the head plates.—Because of the time involved, intensive observation of specimens nearing shedding was continued for only two weeks, and a third case of inflation has not been observed. However, what appears to be a related phenomenon was noted in many specimens of *Natrix sipedon*, *N. cyclopion*, and *N. rhombifera*.

These species, in common with other snakes, typically breathe through their nostrils and each breathing cycle begins with an exhalation.

The specimens referred to above exhibited vigorous, but unsuccessful, attempts to exhale through the nostrils terminated by opening the mouth and allowing the air to escape with a brief forceful hiss. Sometimes the body was compressed several times before the mouth was opened, and there was often a visible expansion of the snout region at the peak of compression. After the burst of air was released from the mouth, a specimen would inhale deeply with the mouth still open, then close the mouth and again attempt to exhale through the nostrils. In specimens examined closely during this behavior, no opening was apparent at the nasal apertures, and movements of the nasal pads were minimal (see below). Sometimes the snout was rubbed along the side of the cage as if the animal was attempting to clear the external nares.

With very few exceptions this behavior was noted only during the pre-molt period and in three cases it led directly into sloughing without interruption.

Action of the nasal valves in Natrix.—I have not observed nasal obstruction associated with shedding in snakes other than the three species of *Natrix* discussed above. Leighton (Zoologist, Ser. 4, 5: 301-4, 1901) recorded the shedding activities of a *Python molorus* over a four year period, and noted that on one occasion after soaking in a tank of water for a few days the specimen began shedding by "sneezing," which served to blow the nasal plates and funnels clear of the nostrils. This is the only prior report of such a phenomenon that has come to my attention.

Leighton's observation plus the habits of *Natrix* suggest that long submergence might directly lead to nasal blockage, perhaps by favoring the accumulation of mucous and particulate matter in the nasal passages. However, obstruction occurred just as frequently in specimens maintained in dry cages and deprived of water except for brief drinking periods. It seems more likely that the degree of development of the nasal pads and their use in *Natrix* are primarily responsible for this phenomenon.

Although the upward displacement of the eyes and nostrils is generally cited as an aquatic adaptation in American watersnakes, the valvular action of the nasal pads in this group has not been stressed. Bruner (Amer. J. Anat., 7:1-117, 1907) singled out the Hydrophids as being the only aquatic serpents with sufficiently well developed pads to serve as valves, and Smith (Copeia, 1942: 256) conceded the addition of only the Homalopsinae to this category. Therefore a few comments on the nasal pads in *Natrix* are appropriate.

At least in the three species considered here (*N. sipedon, N. cyclopion, N. rhombifera*) the pads function to completely close the nasal apertures when the snakes submerge. When the animal is out of water the pads move actively in conjunction with breathing

movements and do not usually close completely between breathing cycles. However, when a specimen is aroused from inactivity the amplitude of the first opening movement of the pad exceeds that of subsequent movements, indicating that while the specimen is resting, even out of water, the pads tend to close the apertures. Similar active movements occur in all snakes which I have examined in this regard (*Crotalus, Pituophis, Thamnophis, Lampropeltis, Heterodon, Elaphe, Arizona, Masticophis*), but they are of much smaller amplitude than in *Natrix*.

Bruner (*op. cit.*) described the blood sinuses surrounding the external nares in snakes, and pointed out that the spongy nasal pad in a Hydrophid resembles erectile tissue. Walker (Copeia, 1959: 247-9) recently reported that marine turtles possess nasal valves which apparently function as a result of local circulatory changes. Control of blood flow through this region may contribute to closure of the pads in *Natrix*. However, in contrast to the situation in turtles, where opening of the nares takes place quite slowly, a specimen of *Natrix* can open the valves instantly upon surfacing. Moreover, the movements associated with breathing continue virtually undiminished while the heart is immobilized through drug action or, in fact, when the head is completely severed from the body. In these snakes, therefore, direct muscular action is involved in opening the nares.

During the pre-molt period, thickening of the epidermis restricts the size of the nasal apertures to a degree which is easily visible. In a resting specimen of *Natrix* this restriction coupled with the tendency of the nasal pads to close reduces the aperture to a narrow slit. A small amount of mucous present in the flattened funnels could easily cause them to adhere in that condition when the specimen attempted to retract the pads at the commencement of a breathing cycle.

The other genera which have been examined exhibit only a slight reduction in the size of the nasal apertures while resting, and there is thus less opportunity for the funnels to flatten and adhere.

The abrupt onset of sloughing.—The general inactivity of snakes prior to shedding is well-known, and Brown (*op. cit.*) cited several of the factors which have been implicated. Almost all specimens of *Natrix* exhibited a period of lethargy during which even strong mechanical disturbance elicited only a mild response or none at all.

In contrast to this general lack of responsiveness were bursts of activity in the absence of any known external stimulus. After two or three hours of inactivity marked only by an occasional shallow breathing cycle, a specimen would suddenly become active, moving quickly about the cage and frequently displaying the behavior described above as characteristic of nasal blockage. In most cases the animal relapsed into inactivity after one or two minutes of this

hectic behavior.

Because of the lack of a gradation in behavior during the pre-molt period the onset of sloughing was unpredictable and seldom observed. The animal passed almost instantly from a state of "preparing to slough" when it was virtually lethargic to a state of "sloughing" when it vigorously and quickly freed the head. This was usually accomplished within a few minutes, with the exception of the two specimens exhibiting inflation of the slough over the snout.

Several facts suggested that obstruction of the nasal passages might be involved in triggering the sudden onset of sloughing. The first was the frequent occurrence of nasal obstruction during the pre-molt period and the similarity between response to such obstruction and the beginning of shedding. Moreover, there seemed to be no precise correspondence between the condition of the skin and the actual onset of shedding. The elapsed time between clearing of the eyes and shedding varied from two to several days, and both the gross appearance of the skin and the ease of sloughing indicated that loosening of the slough over the fresh epidermis had proceeded to varying degrees. One specimen soaked in a water pan until the slough passively fell away from the lower jaw without making an effort to begin shedding. Finally, once the head was cleared specimens often delayed further shedding activity for a day or more.

An attempt was made to clarify this matter by tampering with the nasal plates of eight *Natrix cyclopion* that were nearing shedding. In three of these the development of the fresh epidermis had proceeded far enough to permit removal of the slough over the nasal plates and funnels without damage to the underlying tissue. The nostrils of the remaining five specimens were plugged with minute masses of plasticine. These latter specimens immediately attempted to blow out the plugs and rubbed their snouts against the side of the cage. Their behavior was indistinguishable from that of specimens in which natural obstruction occurred. However, it soon subsided even though examination showed that the nostrils were still effectively blocked. The specimens merely began to breathe voluntarily through the mouth instead of continuing to struggle against the plugs. Neither of the treatments appeared to affect the actual time of sloughing, which ranged over the next four days.

Summary: Two *Natrix s. confluens*, nearing shedding, were observed inflating the slough over the snout region by air blown through the nostrils. Several *N. s. confluens*, *N. rhombifera*, and *N. cyclopion* exhibited behavior attributable to blocked nasal apertures. Pre-molt thickening of the epidermis, coupled with the tendency of the nasal pads to close the apertures in resting *Natrix* is suggested as the probable cause of this phenomenon. The possibility that nasal blockage might serve to trigger the sudden onset of

mechanical sloughing was considered, but preliminary experiments did not provide conclusive evidence on this point.

These observations were made while the writer was being supported by a fellowship from the National Heart Institute, Public Health Service. Specimens of *Natrix* were obtained from the Snake Farm, Laplace, Louisiana. Dr. Raymond B. Cowles and Dr. Richard A. Lockwood contributed helpful comments which are gratefully acknowledged.—ZOOLOGY DEPARTMENT, UNIVERSITY OF CALIFORNIA, LOS ANGELES 24, CALIFORNIA.

NEW RECORDS FOR *HYLA CINEREA* IN MARYLAND, DELAWARE, VIRGINIA AND NORTH CAROLINA.*—In 1956 (Jour. Wash. Acad. Sci. 46(10):328-332) I discussed the status of *Hyla evittata* Miller and stated the reasons for placing this name in the synonymy of *Hyla cinerea* (Schneider). G. S. Miller (1899, Proc. Biol. Soc. Wash. 13: 76) had separated *evittata* from *cinerea* on the basis of the absence of the lateral bright stripe, a broader head and a higher snout in the former. Rarely do all three and sometimes none of these characteristics hold true for any population. Specimens without the bright stripe have been reported from every state where the striped form has been found.

During the past four years observations and collections have been made by Morrison, Daffin, Linsey and Reed in the northern portion of the range of *Hyla cinerea*, from northeastern North Carolina, north to Delaware and Maryland. Specimens with full length stripes, half length stripes, short stripes and without stripes have been taken throughout this range. The percentages in any population of any one type vary from 100% of that type to none, with apparently no greater frequency of one type than the other throughout this range. Specimens with different length stripes on either side or lacking a stripe on one side and a short stripe on the other side have also been taken.

The following published records are noteworthy in reference to specimens without stripes: G. S. Miller (1899, l.c.), Mississippi, Louisiana, Virginia; Van Hyning (Copeia, 1933(1): 4), Florida; Myer (Copeia, No. 131: 60. 1924), Wilmington, North Carolina; Noble and Hassler (Copeia, 1936(1): 63), North Carolina and Maryland; Dunn (Proc. Biol. Soc. Wash. 50: 9-10. 1937), Maryland and Virginia; Werler and McCallion (1951, Amer. Midl. Nat. 45(1): 245-252), Virginia; Conant (Copeia, 1958(1): 50), Delaware (Kent and Sussex Cos.); Brimley (1926, Jour. Eli Mitchell Sci. Soc. 42: 75-92), North Carolina; and Reed (l.c., 1956), Maryland, Delaware, Virginia and the District of Columbia.

*Contributions to the Herpetofauna of Maryland and Delmarva, No. 19.

New unpublished records for *Hyla cinerea* are as follows: MARYLAND: *Harford Co.*: Joppa Farm Road, along Little Gunpowder Falls. June 25, 1957; *Anne Arundel Co.*: Pinehurst along Chesapeake Bay. June 27, 1957; *Somerset Co.*: west of Oriole. May 18, 1957; *Dorchester Co.*: along Steel Neck Road, south of Vienna. May 18, 1957. VIRGINIA: *Lancaster Co.*: Mollusk. May 19, 1957. (USNM-139323-27). Two specimens without stripes, two with long stripes, one with a long and a short stripe. This locality lies on the Northern Neck, near the tip of the peninsula along the Rappahannock River. This species is an addition to the herpetofauna of the area, see Reed (1957, Herpetofauna of Northern Neck, Jour. Wash. Acad. Sci. 47(1): 21-23); *Prince Georges Co.*: 4-6 mi. west of Disputanta. Aug. 15, 1957; *Isle of Wight Co.*: between Windsor and Walters along roadside. Aug. 15, 1957; *Nansemond Co.*: Suffolk. (USNM-37107). NORTH CAROLINA: *Pamlico Co.*: Bayboro. (USNM-135121-28); *Hyde Co.*: Swanquarter near Lake Mattamuskeet. Aug. 17, 1957; Fairfield. Aug. 28, 1958; Engelhard. (USNM-136129-33); *Bertie Co.*: 4.6 mi. south of Powellville. Aug. 17, 1957; *Tyrrell Co.*: Sandy Point. (USNM-133123); *Beaufort Co.*: Washington. (USNM-91745); *Chowan Co.*: Edenton. (USNM-50878).—*Clyde F. Reed, 10105 Harford Road, Baltimore 34, Maryland.*

DELETION OF VIRGINIA FROM THE KNOWN RANGE OF *CLEMMYS MUHLENBERGI*.—The inclusion of northern Virginia in the range of the bog turtle, *Clemmys muhlenbergi*, has been based upon a single specimen, U.S.N.M. 95195, the dried shell of a juvenile turtle collected at Stubblefield Falls, Virginia, by I. N. Hoffman. The record entered the literature through Brady's report (1924, Copeia (135): 92) and was perpetuated by Netting (1927, Ann. Carnegie Mus. *17*: 403-408) and by Barton and Price (1955, Copeia (3): 159-165). A recent examination of this specimen made at the suggestion of Dr. Doris M. Cochran revealed it to be a young *Clemmys insculpta* and not *muhlenbergi*.

Since the only other District of Columbia-Virginia report (Brady, 1937, Proc. Biol. Soc. Wash. 50: 137-140) has previously been held (Barton and Price, *supra cit.*) to be dubious, it becomes necessary to delete this area from the known range of *Clemmys muhlenbergi*. At present, the southernmost stations established in the coastal plain and piedmont provinces for this turtle are those in Cecil and Baltimore Counties of Maryland, some 50 miles to the north. Thus even a greater gap in latitude and altitude seems to separate the northern series of localities for *muhlenbergi* from those in the highlands of western North Carolina than had previously been thought.—*A. J. Barton, The Stony Brook School, Stony Brook, L.I., N.Y.*

Is *Heterodon* Venomous?

By Arthur N. Bragg

The colubrid genus *Heterodon* contains snakes usually considered among the most gentle and inoffensive of North America. For years they have been recommended as reptile pets for children and, so far as I can find, there is no record of any of them biting a human being. Because of this, the following experience with a *Heterodon nasicus nasicus* Baird and Girard of approximately 21 inches overall length seems to be of special interest. I purposely write in considerable detail because of this exceptional interest.

The snake was collected and presented to me in the summer of 1958 by a local boy. It was fed on small specimens of leopard frogs (one to each feeding) in August, October, January, and very early February, each time that it became especially active. Presumably these periods of activity indicated its need for food. It was confined, meanwhile, in a large glass container.

On February 11, I noted casually that it had entered another period of searching movements and planned to feed it again soon. The next morning (Feb. 12) I handled several living and recently dead frogs (*Rana pipens sphenocephala* and *R. catesbeiana*) preparing them for preservation. Then, some minutes later, I had occasion to pick up this snake.

I casually reached for the snake, catching it near its head, and lifted it out. I then *saw* that it had my left thumb in its mouth. I did not feel its bite and it soon began the typical jaw movements of a feeding snake, obviously trying to ingest me! What had happened, of course, was that it had reacted to the frog secretions still on my hand—this was not an act of aggression, of fear, or of defense, but merely one of feeding.

I left the snake there while walking about our building showing this reaction to colleagues. Only after about 10 to 15 minutes (estimated) of this, I noted a picking sensation and after two or three such pickings saw blood. I then removed the snake. Three very small wounds, the largest appearing like a deep scratch, the others as red dots, were present. The largest wound was bleeding freely with exceptionally dark venous blood and one of the others was oozing a little blood. I washed the hand under a convenient faucet, applied a drop of merthiolate as a matter of course, put on an unmedicated plastic band-aid and went back to work. The time was not noted but was close to 10 a.m.

Just after noon, I noticed that my left hand seemed puffy on its dorsal surface proximal and lateral to the thumb; and comparison with my other hand confirmed this. I then began detailed notes. The area itched slightly but was neither sore nor tender at this time.

By 1:35 p.m. the swelling extended over the whole dorsal surface

of the hand, except for an area proximal to the little finger. The swelling was sufficient to give a "tight" feeling and I also noted a very slight burning sensation. There were no other symptoms. Pulse rate was normal and regular (and remained so throughout the incident).

I removed the band-aid at 1:40. This had been placed on the dorsal and lateral surface of the thumb only, so that the swelling could not have been the result of too tight a band. The wounds were closed and the largest measured only 0.5 cm. Hard pressure on the swollen regions showed a slight deep-lying tenderness and I could find no evidence whatever of infection.

In another hour, the swelling had reached the wrist joint and the proximal section of all digits. The hand was now clearly edematous and swollen so badly that it could not be closed. The palm was never involved. There was a vague discomfort in the hand, deep tenderness, but no pain.

At 4:30 there were occasional twinges of slight pain and these increased in frequency and severity when the hand was held down as in walking, noted especially at 5:45 on the way home. This effect lasted for several days.

As a precaution, I obtained medical advice by phone at 8:30 p.m. A warm saline pack was applied (as advised) and continued till morning. So far as I could tell, this had no effect although both then and thereafter the hand was more comfortable when kept warm as in taking baths.

The swelling began to recede at 9:30 a.m. the next day (Feb. 13) and this continued slowly and progressively for several days. Simultaneously, a localized area of considerable tenderness developed dorsal to the metacarpal associated with the first finger. At the present writing (10:35 a.m., Feb. 24) the hand looks normal but this spot is still tender and there is another tender spot below the lateral surface of the wrist joint. It should be further noted that the marked edema experienced probably indicates a change in permability of the capillaries. It is peculiar that the region of the wound was wholly uninvolved, the effect being seen only on the dorsal of the hand and forearm involving the whole region to about ⅔ the way up the arm proximinal to the carpal region.

The foregoing may be interpreted in any of at least three ways: (1) a possible reaction to frog skin secretions; (2) the mild venomous nature of the snake or (3) some obscure reaction to the bite *per se*. Concerning the first I can only point out (a) that in handling thousands of frogs I have never had such a reaction before, even with scratches on my hands, (b) that both hands had frog secretions on them but only the bitten one was affected, and (c) most such secretions were on the palm of the hand and ventral surfaces of the fingers and thumb where only a very tiny amount (if any)

could be injected by the bite on the dorsal of the thumb. Concerning the second we have the statement of Ditmars (1912, *Feeding habits of serpents*, Zoologica 1(1):204) that "In *Heterodon* . . . in the upper jaw is a pair of posterior fang-like teeth that exhibit faint traces of an anterior groove when microscopically examined. Such development may point to the future elaboration of these greatly enlarged teeth into grooved, venom-producing fangs of similar structure to those of the Opisthoghypha." From this, one can easily visualize my experience as evidence that glandular structure in *H. n. nasicus* is tending in the same direction, this snake actually being mildly venomous. Concerning the possibility of so small a wound, without infection, giving this result, I can only say that in more than sixty years of life the innumerable scratches, punctures, bites, cuts and the like which I have received on my hands have never produced anything like this or anything that remotely suggested it.

I, therefore, take this as evidence (but not proof) that *H. n. nasicus* is a mildly venomous snake. Those interested in venomous snakes should look further into the matter.—UNIVERSITY OF OKLAHOMA BIOLOGICAL SURVEY, NORMAN, OKLAHOMA.

AN ALBINO SNAKE (*LAMPROPELTIS CALLIGASTOR RHOMBOMACULATA*).—Since the occurrence of albinism in snakes is relatively uncommon, I wish to record an albino *Lampropeltis calligastor rhombomaculata* (Holbrook) collected in Polk County, Georgia, on the 15th of January, 1960. The living specimen was sent to the writer by Dave Drew, a resident of Cedartown, Ga., who states that the specimen was "collected while sunning . . . ½ mile east of Cedartown."

Description of specimen: This snake is pure albino in appearance, with an opaque white ground color, a red pupil and tongue.

The skin, however, has a small amount of pigment present. The dorsal blotches, which are typical of one color phase of *L. c. rhombomaculata*, are a faint red but present. No traces of melanin are evident.

In scutellation and size the specimen appears to be normal for this subspecies: dorsal rows 22-21-19; ventrals 102; caudals 45; upper labials 7-7; lower labials 7-7; total length 31½ inches; tail length 4 inches; ratio of tail to total length 0.127.

The specimen is preserved in the writer's collection (JTC #80). I wish to thank Messrs. R. Dury and G. T. McDuffie for identification of the albinistic nature of the specimen.—*Jos. T. Collins, Ohio Valley Herpetological Research Lab., Cincinnati, Ohio.*

OVULATION AND BREEDING PATTERNS IN SALIENTIA. In several papers (Turtox News 19:10-2, 1941; Researches on the Amphibia of Oklahoma, University of Oklahoma Press, 1950; and elsewhere) I have indicated that at least three breeding patterns occur in North American Salientia. In allusion to the type of environments in which respectively the first and third of these typically occur as apparent evolutionary adaptations, I have named them the xeric, intermediate and mesic breeding patterns.

For those species or subspecies exhibiting the xeric pattern *only* (e.g. *Bufo cognatus* Say, *Pseudacris clarki* Baird, *Microhyla* (= *Gastrophryne*) *olivacea* (Hallowell) and most, if not all, species of *Scaphiopus*), I suggested on limited evidence (*supra cit.*, 1941), that the clasp of the male might serve as a nervous stimulus to the pituitary and thus initiate ovulation. This was (and still remains) only an hypothesis to be tested; and accepted, modified, or rejected as evidence accumulated.

Immediately after this suggestion was made, Noble and Aronson (Bull. Amer. Mus. Nat. Hist. 80:127-142, 1942) reported that ovulation in *Rana pipiens pipiens* Sch. **precedes** the clasp of the male and they were obviously skeptical of my hypothesis as to the function of amplexus. I then re-emphasized (*supra cit.*, 1950) that my suggestion did not apply to a mesic species and that there was no disagreement because *R. p. pipiens* has the mesic pattern. Indeed, I later concluded that the supposedly xeric breeding *Rana areolata circulusa* Rice and Davis was really a mesic type, primarily because I found an ovulated female approaching a breeding congress (Wasmann Jour. Biol. 12:337-343, 1955).

Yet the generally held assumption that all Salientia **must** ovulate under the same type of stimulation persists. Gosner and Rassman (Copeia 1959 (3): 263-266) report that some eastern members of *Pseudacris* ovulate prior to amplexus and, while they in no sense misquote me, they do leave the impression that I might disagree. I do not. They, like Noble and Aronson, were not studying xeric forms. The whole point that I wish to make is that the validity of the hypothesis as to the function of the male's clasp cannot be decided except **by study of specimens having the xeric pattern of breeding!** Study of mesic forms proves nothing.

So far as I am aware, the only valid published criticism of the hypothesis in question is implied in the work of Hanson (Quart. Jour. Fla. Acad. Sci. 57:1-13, 1959). He found that, in the xeric *Scaphiopus holbrooki holbrooki* (Harlan), females ovulate under the stimulation by water up-take after they enter breeding congresses. Should this be fully confirmed for this and other xeric breeding types it could well supercede or modify my original idea. We obviously need more research on ovulation in the species having the xeric breeding pattern.—*Arthur N. Bragg, Biol. Surv., Univ. of Oklahoma, Norman.*

Birth and Behavior of a Brood of Cottonmouths, *Agkistrodon piscivorus piscivorus* with Notes on Tail-luring

By C. H. Wharton

On September 5, 1956, at 7 a.m., a captive cottonmouth moccasin, *Agkistrodon piscivorus piscivorus* Lacépède, was found to have given birth to two young which were still wet with fetal fluids. Five more were subsequently born under observation. The female was captured September 1, 1956, on Sea Horse Key, Levy County, Florida, during the course of ecological studies. The snake was housed indoors in a glass-fronted wooden cage measuring approximately 100 x 40 x 50 cm. and containing enough sand to cover the bottom to a depth of four centimeters.

When the female was first observed, a pronounced swelling was noted in the posterior third of the body. Prior to giving birth, gentle convulsive twitchings affected the rear quarter of her body. During the act of presentation, the vent was raised two or three centimeters; at the same time the tail was arched and moved slowly from side to side as the convulsive waves passed posteriorly. Twice she moved to examine the newborn with her tongue but returned her head quickly to its original position.

The lengths of time between the five observed births were 6, 18, 33 and 43 minutes. This increasingly greater interval is not understood. Of the five young then born, four were born with fetal membranes intact and one, without. The time to actually expel the young varied from 10 seconds to 5 minutes in the case of a badly presented individual whose neck was apparently broken in delivery. The shortest time between birth and rupture of fetal membranes among the three living young so born was four minutes. One young remained inside the intact membranes for over 11 hours but proved to be stunted and died 49 days later.

The actions of the female while giving birth closely parallel those described by Gloyd (1934) for the copperhead. In the present instance, expulsions were apparently speedier and fetal membranes were more rapidly ruptured than in the case of the copperhead births.

By closely watching the sides of the newborn snakes, I could detect some breathing movements. Prior to breathing, each newborn opened its mouth widely, often repeatedly. The first breathing movement closely followed this action. With the fifth and sixth young, it was observed that the first breath occurred about one minute after rupture of the enclosing sac; breathing in both cases occurred before the young snake had left the membranes. In one instance, the snake had only the head protruding, and each breath

caused the membrane to writhe considerably. These breaths were full, apparently involving the entire length of the air sac. Breaths for the first hour were steady at two, sometimes three, per minute. There was a tendency for this rate to decrease after a few hours to one breath per minute when there was no movement.

Heart rate was less successfully detected than breathing. If the snake was coiled in such a manner that the region between blotches three and five was readily visible for close scrutiny, it was possible to see pulsations which were either heart rate or shallow breathing involving only the alveolar portion of the lung. In some, highly irregular pulsations of this nature were noted. In others, there appeared to be a steady pulse of about 36 per minute at approximately 21°C. which increased from 4 to 10 beats per minute after crawling activity. Following a one meter dash across the terrarium, the count of one rose to 58 pulsations per minute but dropped to 44 at rest; it rose to 60 when the snake was disturbed by being touched with a wire.

Few observations were made on the response of the young to temperature changes. It was noted, however, that when the temperature dropped noticeably, all of the baby snakes were found tightly coiled. Some buried themselves in the leaves; others coiled together.

Four days after birth, five of the baby snakes had milky eyes. In one wild brood discovered in this condition on Sea Horse Key, the young snakes were still with their mother; indicating that, in this case, the young cottonmouths had remained with their mother for at least a few days following birth. Eyes of the captive brood cleared on the seventh day, and the first shed skin was observed eight days after birth. Gloyd (*loc. cit.*) observed that most young copperheads shed on the seventh or eighth day.

The first drinking reflex occurred seven days after birth, when one, sprinkled with water, presumably drank from droplets on the floor of the cage. Since the island environment of Sea Horse Key possesses no fresh water, it was of interest to learn how the young snakes behaved in response to simulated rainfall. On December 9, water was splattered on the young snakes. They immediately became alert and began crawling and nosing here and there. They drank from droplets on their own bodies, on the bodies of cagemates and especially from dead leaves which covered the sandy bottom of the cage. Normal drinking movements of the jaws and throat were observed. In Florida habitats, leaves of the live oak, *Quercus virginiana,* are so curled that they form natural catchment basins for rain and dew. In addition to drinking from water drops following manual springling, three of the five active young found and drank from one of two petri dishes within 15 minutes after the vessels had been placed in the cage.

Young cottonmouths are born with considerable yolk material in the gut. A newborn male, 337 mm. in length, weighed 32.5 grams, and possessed 3.8 grams of yolk at birth. Gloyd (*loc. cit.*) found that yolk in newborn copperheads ranged from 13.8 to 29.2 per cent of the total weight, and, in two snakes, was completely used up within 15 days of birth. He did not state the temperature.

The reduction of metabolic rate with the advent of cold weather (and to some unknown extent the yolk material) should enable the young to survive until the following spring. To test this supposition, I placed four young (born September 5, 1956) in a gallon jar containing 12 mm. of sand. They were kept in an unheated room at Sea Horse Key and were watered infrequently in an attempt to roughly approximate natural conditions on the island. The first death occurred in May, eight months after the experiment was initiated; another died in June; and the remaining two survived until mid-July. Newborn young, at this latitude in Florida at least, have the ability to survive well into the following spring, when food again becomes available. The mean weight of the four specimens at their death, 16 grams, may be compared with the mean of 28.7 grams for nine newborn young (mean length 338 mm.). The weight loss sustained by several of these young approached 50 per cent.

It is a curious fact that juveniles of a number of species of the genus *Agkistrodon* have acquired a unique feeding habit involving a conspicuously-colored tail tip manipulated so that it appears to imitate a worm and thus attracts small reptiles and amphibians to within striking range of the immobile young snake.

The first recorded observation of this behavior was published in 1924 by G. M. Henry, quoted by Smith (1943). On several occasions Henry observed the whitish tail tip of young hump-nosed vipers, *Agkistrodon hypnale*, moving in response to small geckos and skinks introduced into the cage.

Neill (1948) was apparently the first to publish an observation on a North American *Agkistrodon* engaged in this novel means of luring prey. In 1939 he observed wriggling tail tips in juvenile copperheads, *Agkistrodon mokasen*, in response to cricket frogs, *Acris gryllus*. Allen (1949) described similar behavior in a brood of juvenile cantil, *Agkistrodon bilineatus*, from Mexico.

As far as the author is aware, this phenomenon has not been recorded for the cottonmouth. On November 20, 1956, I and several graduate students at the University of Florida observed tail-luring in the brood of cottonmouths born September 5. While toads occupied the cage, none of them were active nor did they attack the moving tails. The appearance of the young snake is that indicated in fig. 1. The snake appeared in an attitude of attention, and most of the young were similarly coiled, with tail tips elevated to similar heights, about six centimeters from the ground. The tail was undulated

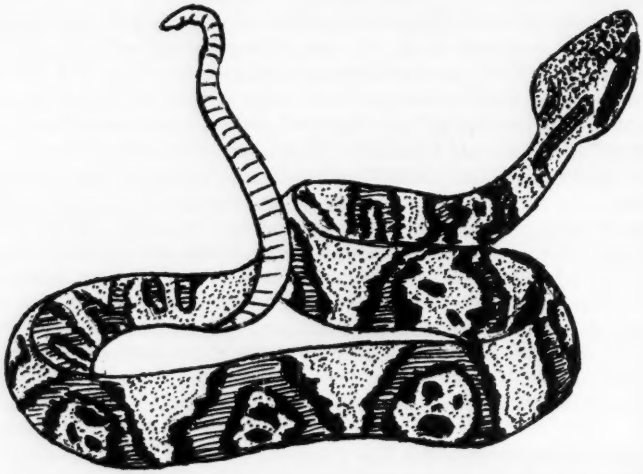

Fig. 1. Position of juvenile cottonmouth while using the tail as a lure. The snake is 76 days old.

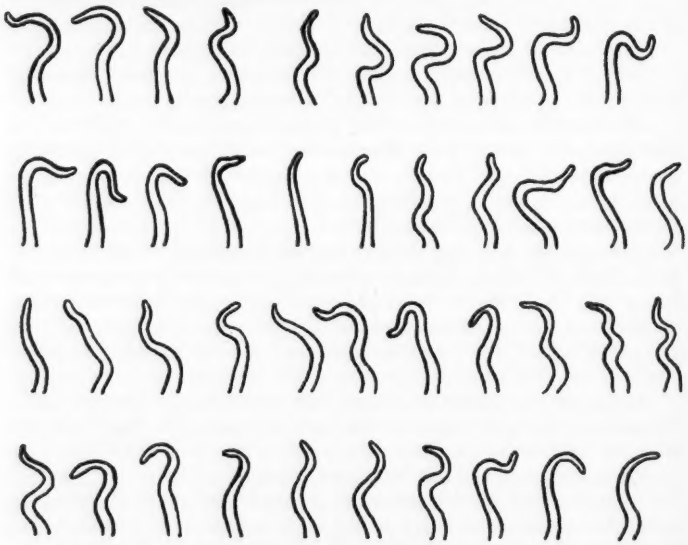

Fig. 2. Sketches showing successive positions of the tail tip of a juvenile cottonmouth while luring with the tail. (Begin at top, read to right.)

slowly from side to side and resembled a yellow larva with the posterior end of the body anchored and the other searching for anchorage. The movements appeared to be in a single plane; that is, if the subcaudals were visible, they remained visible during the action. Curves were formed successively about an inch back of the tip and passed toward the extremity of the tail. Figure 2 indicates successive movements of the yellow tail tip; the drawings were made as rapidly as possible so as to give a continuity of movement. A new curve usually began before the preceding one had passed completely to the tip.

The presence of observers seemed to have little effect on the tail activity. Tail movements were observed under artificial light and ceased at 7:20 p.m., although the lights remained on. Movements on the following day were resumed at 7:40 a.m. These observations are too scanty to do more than suggest that this is a solely diurnal phenomenon.

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GEORGIA STATE COLLEGE, ATLANTA, GEORGIA

A MELANISTIC *TARICHA GRANULOSA GRANULOSA* SKILTON.—On June 18, 1952 Dr. R. M. Storm and I made a collection of 115 *Taricha granulosa granulosa* from an artificial pond on the south side of Coffin Butte, nine miles north of Corvallis, Benton County, Oregon. In this collection was one specimen that exhibited an extreme melanistic condition. It was an adult male in breeding condition, 182 mm. total length, with a snout-vent length of 79 mm.

Dorsal coloration was a deep blackish-brown, darker than the usual condition in this form. The ventral surface of body, tail and limbs was also blackish-brown, only slightly lighter than the dorsum. This ventral melanism was uniformly distributed, with no blotching nor any indication of the yellow-orange pigment characteristic of this species. A band of the dorsal pigmentation extended ventrad completely covering the swollen cloacal lips. Even the eyes were completely pigmented with melanin.—*R. L. Livezey, Sacramento State College, Sacramento, California.*

NATRIX VALIDA IN SONORA, MEXICO.*—On 20 August, 1959, we collected a specimen of *Natrix valida* (Kennicott) at the Rio Yaqui where it is crossed by Highway 15, approximately three miles north of Ciudad Obregon, Sonora, Mexico. The adult male specimen was captured beneath some matted *Jussiaea* on the bank of the river at 10:00 a.m. on a rainy morning. Comparison with Conant's, 1946 (Amer. Midl. Nat. 35:253), diagnostic characteristics for *N. valida* reveals that the scutellation and color of this specimen are typical of the subspecies *N. v. valida*. The total length of our specimen (618 mm.) exceeds that of the largest male specimen (605 mm.) measured by Conant.

Knowledge of the habits and habitat of *Natrix valida* is very fragmentary. Consequently, the following notes have been taken from our field journals in order to adequately describe the habitat at this locality. The Rio Yaqui, near the collecting site, has been largely diverted from its channel by an upstream irrigation project. The reduced stream flows over a bed which once contained a much broader river. The broad river bed is richly vegetated by aquatic and sub-aquatic plants, such as species of *Juncus, Eichornia, Polygonum, Jussiaea, Cyperus,* and *Asclepias.* The river is also subject to strong influence from the nearby Gulf of California, and collections of fishes from this site contain several marine and estuarine species. This association could be generally described as a coastal plain-river bottom type.

Although specimens of *Natrix valida* have previously not been reported from Sonora, several authors have suggested that it eventually would be found in the state. Cope, 1892 (Proc. U. S. Nat. Mus. 14:670), included "Sonora" in the range of *Natrix valida* but subsequent writers have assumed that Cope referred to the "Sonoran Biotic Province" rather than to the state of Sonora. The discovery of this species raises the question of whether Cope had knowledge of its occurrence in Sonora. Bogert and Oliver, 1945 (Bull. Amer. Mus. Nat. Hist. 83:6 p. 414) listed *Natrix valida* as a probable member of the fauna of Sonora but did not anticipate the extensive range in the state that the present record indicates.

The most northern mainland occurrence of *N. valida* previously known was at Culiacan, Sinaloa. The Rio Yaqui specimen extends the known range of the species approximately 250 miles northwest in the coastal plain.—*Clarence J. McCoy, Jr., Branley A. Branson, and Morgan E. Sisk, Stillwater, Oklahoma.*

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*Contribution number 311 from the Department of Zoology and the Research Foundation of Oklahoma State University.

Amphibians of Eastern South Dakota

By DALE W. FISHBECK AND JAMES C. UNDERHILL

During the years 1955 to 1959 collections in eastern South Dakota have yielded more detailed information on the distribution of amphibians than that reported by Over (1923, 1943), O'Roke (1924) and Underhill (1958). All specimens collected have been deposited in the State University of South Dakota collection. A total of thirteen species occur in South Dakota east of the Missouri River.

The main interest of herpetologists has been the fauna of the Black Hills and Badlands of South Dakota. This interest is reflected in the paucity of material in various museum collections from all but the latter regions of South Dakota. A few specimens from eastern South Dakota are present in the Yankton College collection, Yankton, South Dakota.

The eastern border of the state lies in a transitional zone between the deciduous forest and the western prairies. It is a region of ecological diversity that has received little attention from ecologists and is perhaps most often viewed as an area that must be crossed to reach the "west river country." While the greater portion of the state east of the Missouri River is prairie grassland, extensive areas of floodplain forest exist in the valleys of the Missouri, James and Big Sioux Rivers. Rich deciduous forests are present in the moist east facing coulees of the Coteau des Prairies in Grant and Roberts Counties, northeastern South Dakota. West of Springfield, Bon Homme County, in the Missouri River Valley, several large natural artesian wells exist. These have produced a swampy habitat not characteristic of the remainder of the floodplain.

On the Coteau des Prairies, from Madison north to the North Dakota border, a lake region which contains thousands of small pothole lakes and many large shallow lakes is encountered. Severe droughts are characteristic of the general area, the earliest recorded in 1894, the famous drought of the 1930's and the most recent in 1959. During these periods of low precipitation all but a few of the larger lakes were reduced to tremendous mud flats. In 1937 all but Blue Dog, Enemy Swim, Pickerel and Poinsett Lakes were dry or reduced to a few puddles. Fluctuations in precipitation during the spring have profound effects on the amphibian populations. Reconnaissance trips through the western counties of eastern South Dakota in 1958 and again in June 1959 revealed few amphibians. Many of the counties were in the grip of a severe drought and lakes marked on the county maps were either sun baked mud flats, pastures, or planted in field crops. A few lakes that had only recently filled with water, as a result of local torrential rains, were devoid of life. Farmers in several areas reported that many of the lakes had been dry for over five years. These areas should be investigated at

some later date when rainfall returns to normal. It would provide an almost unique opportunity to study repopulation of an area by amphibians since in many instances the source regions would be at least fifty miles away.

The following annotated list of the species of amphibians from eastern South Dakota is based on specimens in the State University of South Dakota collection unless otherwise noted.

Necturus maculosus maculosus (Rafinesque). The mud puppy is known from Big Stone Lake (Breckenridge 1944). Frequent reports of the mud puppy from the larger lakes have in all cases been the larvae of the tiger salamander. With the exception of three or four of the larger lakes it is doubtful that this species could survive in the lake region of northeastern South Dakota because of the prolonged droughts of the 1890's and 1930's.

Ambystoma tigrinum Green. The tiger salamander is common throughout eastern South Dakota but varies in abundance depending upon the annual precipitation. In years with normal rainfall (24 inches) this salamander is found in great numbers in and near temporary and permanent ponds.

The tiger salamander is probably represented by two subspecies in this region, *tigrinum* and *melanostictum*, but there are too few specimens extant to reach a definite conclusion about the subspecific status of our material. Specimens from the southeastern corner of the state appear to be *tigrinum*, while those from the remainder of eastern South Dakota are *melanostictum*.

On July 12, 1958 a large population was discovered in a gravel pit near Buffalo Lake in Minnehaha County. These larvae ranged in length from 66 to 220 millimeters. Three of the larger specimens were thought to be axolotls as they appeared to be sexually mature. Unfortunately, in the fall of 1958, the gravel pit was reactivated and the salamander population destroyed. Specimens that were brought into the laboratory completed their metamorphosis in early September. The size distribution of 90 larval salamanders collected is presented in table 1.

Scaphiopus bombifrons Cope. The western spadefoot toad is common in extreme southeastern South Dakota. More intensive collecting indicates that the range as reported by Underhill (1958) is essentially correct, with the northern limit in the eastern portion of the state marked by a line running east and west from the Minnehaha-Turner County line to northern Hutchinson County.

Bufo cognatus Say. The great plains toad is apparently the only species of toad that ranges over the entire eastern half of the state.

Bufo terrestris americanus Girard. An American toad was first taken at Garretson, Minnehaha County (Underhill 1958). Further collecting has yielded several more from east central South Dakota;

west end of Lake Madison, Lake Co.; Lake Alvin, Sioux River southeast of Lake Alvin, and Sioux River below Klondike, Lincoln Co.; Buffalo Lake, Minnehaha Co.; Lake Campbell, Moody Co. In addition to the above specimens there is one in the South Dakota collection from Larchwood, Lyons County, Iowa. The latter specimen indicates that the range of the American toad extends across northern Iowa (Bailey and Bailey 1941) into eastern South Dakota. The American toad therefore has a more western distribution than was formerly thought. Its range in South Dakota is apparently restricted to the more mesic habitats near lakes and streams and is not in the typical grassland habitat.

Bufo woodhousei woodhousei Girard. Woodhouse's toad is common in southeastern South Dakota, south and west of the range of the American toad. It is most common in the floodplain of the Missouri River and its tributaries and is replaced on the uplands by *B. cognatus*. *Bufo woodhousei* usually breeds in late April and early May but in the spring of 1959 breeding was delayed and *B. woodhousei, B. cognatus* and *Scaphiopus bombifrons* were observed using the same temporary pond for breeding. While the latter two species commonly use the same ponds this was the first time that all three had been found together.

Bufo hemiophrys Cope. The Dakota toad is very abundant in northeastern South Dakota. Several new locality records are reported here, Oakwood Lakes, Brookings Co.; Tacoma Park, 10 mi. NE of Aberdeen, Brown Co.; and Lake St. John, Hamlin Co. All specimens have come from the northern portion of the Coteau des Prairies, southward it is replaced by the American toad.

The ranges of the Dakota toad, American toad and Woodhouse's toad are complementary in eastern South Dakota. The Dakota toad to the north, Woodhouse's toad to the south, and the American toad in the central portion of the Coteau. The Great Plains toad ranges over the entire eastern half of the state.

Acris gryllus Le Conte. The cricket frog has a more restricted range in South Dakota than that reported by Wright and Wright (1949). There are specimens in the University of South Dakota collection from Bon Homme, Charles Mix, Clay, Hanson, Hutchinson, Turner, Union, and Yankton Counties (Fishbeck and Underhill 1959). The most northern record is from the outlet of Lake Hanson in Hanson County. Breckenridge (1944) and Bailey (1944) have reported cricket frogs from the Sioux River basin in Minnesota and Iowa. Intensive collecting in the Sioux River Valley in South Dakota failed to reveal this frog north of the Union County line. The absence of cricket frogs in this basin in South Dakota may be explained by the lack of small tributary streams which appear to be the preferred habitat of the species in this region. It is found in the Missouri River floodplain but is common only in the small side channels.

The binomial is used as Mary Keene Fishbeck is currently undertaking a study of South Dakota specimens.

Hyla versicolor Le Conte. The range of the common tree frog is restricted to the floodplain of the Missouri River in South Dakota. A single specimen is present in the South Dakota collection from the Springfield area of Bon Homme County; this specimen and the one in the United States National Museum (68719) were collected by Professor O'Roke in 1924. There are two specimens in the Yankton College collection with the locality listed simply as Yankton County. Individuals from Bon Homme County came from marshes in the vicinity of natural artesian wells at the base of the south facing bluffs of the Missouri River. Here there exists a microclimate and a habitat similar to that occupied by the species in the eastern and southern range. Artesians were common in the river bottoms of Yankton County prior to the construction of Gavins Point Dam and it is quite possible that the specimens in the Yankton College collection came from such habitats. Whether populations of the common tree frog still exist in this area is questionable, but on two occasions single individuals of what was thought to be *H. versicolor* were heard calling.

Pseudacris nigrita (Le Conte). Swamp chorus frogs are common throughout South Dakota. Smith (1956), in a treatment of the boreal chorus frog, has stated that specimens from the eastern part of the state are *maculata* x *triseriata* intergrades. In our material there is a marked difference in the frequencies of striped individuals in samples from the southeastern section of the state and the east central section. Of 26 southeastern individuals 22 or 85.7% were striped and 4 or 15.3% were spotted. A sample from Buffalo Lake, Minnehaha County contained 23 striped and 19 spotted individuals, or 54.7% and 45.3% resepctively. Although the latter sample was small there is a greater proportion of spotted males than females. The ratio of spotted to striped males was 12:8, while in the females the ratio was 7:15. All of the spotted individuals from the southeastern part of the state were males. A suggestion of sexual dimorphism is certainly presumptuous with such a small sample, although the possibility perhaps deserves further investigation.

Rana catesbiana Shaw. The bullfrog, although apparently native to extreme southeastern South Dakota (Wright and Wright 1949), has been taken only once. It was taken from a small backwater pool on the shore of Lewis and Clark Lake in Bon Homme County. Bullfrogs are common in the stock dams of Lyman, Tripp and Gregory Counties, west of the Missouri River. Natives report that they were abundant in the floodplain of the Missouri River at the turn of the century.

Rana sylvatica Le Conte. There is a single specimen of the wood frog from Hartford Beach, Roberts County in the United

States National Museum (65452). Mr. Over (1923) also reported this species from the coulees at the headwaters of the Minnesota River. The latter region was visited at least twice each field season specifically to search for the wood frog but none was found. However, there is little doubt that the species may have been present in this very intriguing area.

The coulees contain numerous springs and rich deciduous forest stands; a habitat that is similar in many respects to that of the wood frog in the Lake Itasca region of Minnesota. The coulees have rather small areas so it is not too surprising to find that the wood frog has been extirpated. Habitat modification may also have been a contributing factor as these areas were used by the Sisseton Sioux as wintering ground for a number of years following Mr. Over's visits. During their stay most of the timber in the bottoms was cut for lumber and firewood and until very recently there was some grazing as well.

Rana pipiens Schreber. Meadow frogs are common throughout eastern South Dakota. Its abundance is determined by the amount of rainfall that occurred the previous spring. Both mutant forms, *burnsi* and *kandiyohi*, are found in the lake region of the northeastern and east central portion of the state.

Table 1. Total lengths of larval *Ambystoma tigrinum* from Minnehaha County, South Dakota.

Length in mm.	Number of individuals
60 - 69.9	1
70 - 79.9	5
80 - 89.9	17
90 - 99.9	12
100 - 109.9	21
111 - 119.9	19
120 - 129.9	6
130 - 139.9	4
140 - 149.9	..
150 - 159.9	2
190 - 199.9	2
220 - 229.9	1

The amphibian fauna of eastern South Dakota while small in number of species is rather diverse in origin. Of the thirteen species presently known from South Dakota east of the Missouri River, two, *Rana sylvatica* and *Bufo hemiophrys*, are boreal; five, *Hyla versicolor, Acris gryllus, R. catesbiana, B. t. americanus*, and *Necturus maculosus*, are eastern and southern forms; three, *Scaphiopus bombifrons, B. cognatus* and *B. woodhousei*, are western and southern forms; the three remaining species, *R. pipiens, Pseudacris nigrita*

and *Ambystoma tigrinum*, are widely distributed in North America. This diversity is a reflection of the many different habitats existing in this ecotonal area. It may be viewed as an example of the "edge effect." More field and laboratory work must be done before valid ecological interpretations can be made about the factors limiting the distributions of the various species.

The assistance of Alfred Bull, Judith Dailey, Donald Fanslow, Homer McAllister, and Ross Shaw in the field work is gratefully acknowledged. The kindness of Dr. Doris M. Cochran of the United States National Museum and Dr. Frank W. Jobes of Yankton College in allowing us to examine specimens in their charge is greatly appreciated. A grant in aid from the research fund of the State University of South Dakota made the field work possible.

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DEPARTMENT OF ZOOLOGY, UNIV. OF MINNESOTA, MINNEAPOLIS, MINN.

Parturition and Behavior at Birth of Yarrow's Spiny Lizard (*Sceloporus jarrovi*)

By CHARLES C. CARPENTER

A series of twelve adult Yarrow's Spiny Lizards (*Sceloporus j. jarrovi*) collected on March 29 and 30, 1959 in the Chiracahua and Huachuca Mountains of southeastern Arizona were contained in cages until early June at which time they were released in a 10 by 20 foot enclosure at the University of Oklahoma Biological Station. When parturition appeared imminent, a female was placed in a one cubic foot cage.

Sixty young were born to six of the eight females as follows: a female measuring 8.5 cm. (s-v length) gave birth to 10 young on June 4; and respectively a female 8.5 cm. - 11 young and 8.1 cm. - 11 young on June 13; 7.0 cm. - 7 young on June 16; 8.1 cm. - 8 young and 7.4 cm. - 13 young on June 17. Parturition of the last five litters occurred between 11:00 a.m. and 1:30 p.m., and that of the first between 7:30 and 11:00 a.m.

Evidence of impending parturition was indicated by the bloated appearance of the female and the onset of labor movements in the abdominal region. The movements appeared as violent contractions which often caused an undulating of the posterior part of the trunk and moved the whole body forward. The number of labor contractions preceding a birth was variable. Just previous to birth, the female raised her pelvic region and tail high by extending her hind legs forming a large arch.

The time for the emergence of a membranous sac with a young lizard was from one to two seconds. As one emerged, it fell to the sand, and if the female was up on the side of the cage, this drop may have been as much as 8 to 10 inches. Frequently the female jerked her cloacal region as the sac emerged, as if to shake it loose. A female which had completed her litter usually moved about intermittantly dragging her pelvic region in the sand for a minute or two, and often stopped to perform push-ups.

The interval between births was recorded 18 times, representing four females, and ranged from two individuals emerging simultaneously to an interval of 39 minutes, with an average interval time of 9 minutes.

The young in the membranous sac, immediately after birth, was motionless for a few seconds in a flexed position, the tail and legs lying under the throat region. The first apparent movements were seen as body jerks and head twists. The head was twisted to the side violently and it was this motion that appeared to break the membranous sac and free the young lizard. The first movements by the young in the sac usually appeared at about 5 to 30 seconds, but may

have waited as long as 2½ minutes. The number of jerks or twists necessary to break the sac varied from one to six. Sixteen individuals were timed from the moment of emergence from the female to the escape from the sac; the shortest time was 40 seconds and the longest 17½ minutes (13 of the 16 emerged from their sacs in two minutes or less).

The young lizard usually moved from the sac as soon as it broke, but a few remained motionless in the broken sac for a few seconds before moving out. When moving from the moist sac, the yolk stalk often remained attached to the belly and this in turn held to the other membranes which often became entangled with the hind legs of the small lizard. Two small lizards could not free themselves from the membranes and had to be helped. It is very conceivable, from my observations, that such entanglement of the hind legs with the drying membranes could happen in nature and cause some mortality.

On emerging from the sac, the young lizard very noticeably gulped for air and this probably filled the lungs for the first time and started normal respiration. They also blinked their eyes soon after the sac broke. Both the gulping for air and blinking were observed in a young lizard with only the head protruding from the sac. The newly emerged lizards were very alert and agile, scampering across the sand and climbing the sides of cage within a few seconds. Within a minute or two they began to use their tongues to test the environment.

Perhaps the most significant feature was the appearance of the push-up or bobbing behavior. This was observed repeatedly in individuals only a few minutes old, and in one individual approximately one minute out of the sac, and with the membranes still clinging to its hind legs. The presence of a push-up movement at this early stage presents the possibility that it might be related to movements necessary for breaking from the membranous sac at birth and should be investigated in this light. Maternal recognition or response to the young was not exhibited by the females.

The young ranged in snout-vent length from 2.6 to 2.8 cm. (av. 2.7) and in total length from 5.3 to 6.0 cm. (av. 5.7). In weight, they ranged from 0.35 to 0.70 grams (av. 0.51).

All the young had the same color pattern, and the only apparent difference in pattern between the newly born and the adults is the prominence of two slightly irregular rows of dark spots on each side of the mid-dorsal line. Other dark spots appeared at random over the trunk lateral to these two rows. These spots apparently fade out or become less conspicuous with maturity.

DEPARTMENT OF ZOOLOGY,
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Remarks on the Natural History of the Big Bend Slider, *Pseudemys scripta gaigeae* Hartweg.

By JOHN M. LEGLER

In June 1959, the writer, assisted by Craig Nelson and other members of a University of Kansas field expedition, collected series of *Pseudemys scripta gaigeae* at the following localities: Río Grande, Lajitas, Brewster County, Texas (six specimens); Río Conchos, 1 mi. NW Ojinaga, Chihuahua (nine specimens); and, junction of Río San Pedro and Río Conchos, 3 mi. N and 5 mi. E Meoqui, Chihuahua (20 specimens). All specimens are now in the herpetological collection of the Museum of Natural History, University of Kansas. Taxonomic studies of these specimens will be reported elsewhere. In view of the paucity of published information on the natural history of *P. s. gaigeae* (and on Mexican turtles in general), the following observations are set forth as noteworthy.

Sliders were captured in double-throated hoopnets ranging in diameter from 16 to 30 inches. The nets were baited with canned sardines (prepared in soybean oil). This bait also attracted softshelled turtles (*Trionyx spinifer emoryi*) and musk turtles (*Kinosternon murrayi*). At Lajitas softshells were the most abundant turtles, sliders were uncommon, and musk turtles were rare; about the same situation, in regard to relative abundance, prevailed at Ojinaga. At the junction of the San Pedro and Conchos, however, *Kinosternon murrayi* was the dominant chelonian species and *Trionyx* and *Pseudemys* were obtained in lesser, nearly equal numbers.

Sliders (like softshells) were found only in permanent bodies of water, except for a small specimen of *P. s. gaigeae* that was obtained in a small temporary pool several hundred feet from the Conchos at Ojinaga. *Kinosternon murrayi*, however, was obtained in all aquatic situations in which traps could be set.

Of the several stomachs of *Pseudemys* opened, all contained only aquatic vegetation. Carr (Handbook of Turtles, 1952:264) regarded *P. s. gaigeae* as a carnivorous subspecies.

Few basking sites were available in the habitats studied and consequently few sliders were seen basking on out-of-water objects. At the mouth of the Río San Pedro, however, numerous individuals were seen basking at the surface of the water, chiefly in morning and late afternoon.

Four females had complements of oviducal eggs on June 26 as follows: 11, 9, 7, and 6. These females had carapaces that were 202, 186, 194, and 169 mm. long, respectively.

Females known to be sexually mature (as revealed by examination of gonads) ranged from 169 to 208 mm. (hereinafter, measurements are length of carapace). Several females were regarded as

subadults since they had attained adult proportions but had immature ovaries; these individuals were 152 to 183 mm. long. Eleven sexually mature males had an average length of 138 mm. (range, 115 to 166 mm.). Secondary sexual characteristics (plastron slightly concave, preanal part of tail enlarged) were partly developed in a male that was 103 mm. long. Individuals that were longer than 100 mm. and still had juvenile proportions were regarded as immature if they could not be dissected. On the basis of the specimens examined, it seems that most males of *gaigeae* attain sexual maturity at lengths of 105 to 115 mm. whereas most females attain maturity at lengths of 170 to 180 mm. The largest male (166 mm.) and female (208 mm.) examined are not indicative of maximum size in *gaigeae* inasmuch as much larger individuals (probably females) were seen in the Río Conchos near Meoqui. Narrowness of the openings of traps is probably the chief reason that these larger specimens were not caught.

At Ojinaga and Meoqui the local name for *P. s. gaigeae* is *pinto*. Most natives allowed that *pintos* were good to eat but I could find no one who had actually used them for food.

DEPARTMENT OF ZOOLOGY AND ENTOMOLOGY,
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CROTALUS MITCHILLI PYRRHUS COPE IN UTAH.—On May 2, 1960 an adult male was taken by Mr. W. Gerald Robison, Jr., approximately 4.5 mi. W of Castle Rock, Washington Co., Utah (6 mi. N of the Utah-Arizona line and 4 mi. E of the Utah-Nevada line). Previously this species had been taken approximately 6 mi. S of the Utah-Arizona line, at the Virgin Narrows NE of Littlefield, Mohave Co., Arizona (Woodbury and Hardy, 1947. Herpetologica 3:69) and Nelson, El Dorado Canyon, Nevada (near Colorado River below Boulder Dam. Cowles and Bogert, 1936. Herpetologica 1:41).

The present specimen (BYU 1625) was taken on a rocky NE slope below a ledge. This locality is surrounded by Joshua trees.

There are 33 brownish-buff dorsal blotches on body; 6 on tail, the first three the same color as those of body, the last three black; ground color light buff; dorsals 25-25-18; ventrals 176; caudals 25; supralabials 16-17; infralabials 15-15; total length 873 and tail 80 mm. There are four postrostrals, the upper preocular is single, no sutures or pitts on supraoculars; prenasal in broad contact with rostral and only the last few dorsal blotches fuse with the lateral spots to form transverse bars.

Although Woodbury and Hardy (*loc. cit.*) considered the Mohave Co. specimen an intergrade between *pyrrhus* and *stephensi*, the Utah specimen apparently, except for the prenasal-rostral contact, has the usual, *C. m. pyrrhus* characteristics.—*Wilmer W. Tanner, Brigham Young University, Provo, Utah.*

Late Summer Oviposition in the Salamander, *Plethodon cinereus*

By Marilyn Davidson and Harold Heatwole

Abbott (1884) stated that *Plethodon cinereus* lays eggs in June and again in August. Bishop (1941) considered it unlikely that any one female would be involved in two reproductive periods in the same year because of the length of the developmental period during which the female remains with the eggs. On the other hand, clutches of this species have been obtained on dates sufficiently late in the autumn that despite possible variation between geographical areas, two oviposition periods are suggested. The latest recorded date on which eggs of *P. cinereus* have been found was September 25 (Sherwood, 1895).

The present note reports on some observations made in the vicinity of the University of Michigan Biological Station in the northern part of the Southern Peninsula of Michigan during the period 1957-59. These observations provide positive evidence that two distinct oviposition periods do exist in this species and that different females participate in each.

Blanchard (1928) obtained evidence that in this region, *P. cinereus* oviposits soon after the middle of June. Our observations agree with this conclusion. In June, 1959, sixteen clutches of eggs were collected in the field. They were kept in the laboratory under favorable moisture conditions and at 66° F., a temperature closely approximating those recorded throughout the summer in logs from which eggs were taken. Hatching occurred between July 29 and August 9. On August 14, 1957, a clutch was observed in the field in the process of hatching. In 1959, a similar observation was made on August 3. Thus the embryonic period resulting from the first ovipositing season is from the middle of June to early August.

One particularly notable oviposition record was obtained. On August 2, 1959, we found three newly-laid eggs in the interior of a large hemlock log. A striped female 38 mm. long (s-v) was attending them. The undeveloped eggs were 0.5 cm. in diameter, and consisted largely of yolk, except for a small transparent disc on top. Other clutches found in the field this late in the summer had well-developed embryos completely enclosing the yolk and possessing eyes, gills, and a pigmented skin.

The female had apparently been interrupted in the process of oviposition as three eggs approximately the same size as those she was attending could be seen in the oviducts through the body wall. A fourth but smaller egg was also visible.

The clutch and attendant female were transported to the laboratory and observed periodically. The eggs hatched on the 20th and

21st of September, about a month and a half later than other hatching dates. The female resorbed the oviducal eggs prior to this date. The latest collecting for any of the years was on August 14, and hence the extent of late summer oviposition is not known. The second period apparently begins in middle August while the eggs from the first period are hatching. This suggests that Bishop was correct in his conclusion that a given female does not oviposit more than once each year.

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DEPARTMENT OF ZOOLOGY, UNIVERSITY OF MICHIGAN, ANN ARBOR.

A LARGE BROOD OF WESTERN PIGMY RATTLESNAKES. The largest litter recorded for the western pigmy rattlesnake (*Sistrurus miliarus streckeri*) by Klauber (Rattlesnakes, 1957, Univ. Calif. Press) is 7 and Wright and Wright (Handbook of Snakes, 1957, Comstock Publ. Assoc.) list a range of from 6 to 14 young per litter. Klauber (*Ibid.*) also lists the largest litter record for *S. m. barbouri* as 18.

The following account concerns a litter of thirty-two young born to a very large female *Sistrurus miliarus streckeri* that measured 52.5 cm. in snout-vent length, 59.0 cm. to the base of the rattles and 60.2 cm. with the seven rattles and the button, and weighed 220.5 grams. This snake was collected by Dr. George M. Sutton, on June 29, 1959 near the headquarters of the Tishomingo National Wildlife Refuge, Johnston County, Oklahoma, along the beach drift line of Lake Texoma. The date of birth was August 6, 1959.

The birth activity was first noticed at 4:45 p.m., at which time 20 young had already been born. The succeeding births were observed and photographed.

Labor movements were very evident in the abdomen of the female and a few seconds prior to the emergence of a fetal sac these movements increased in intensity. Each young emerged in a very moist, transparent membranous amniotic sac in which a coiled body could be seen. When the sac emerged, the female appeared to jerk her cloacal region, as if to break loose from the sac.

In five to ten seconds after emergence, a young snake broke from the sac by attempting to extend its body from the coiled position. This forced the head through the membrane. Each small snake rested a few seconds then crawled from the sac. The young began to crawl around the cage within a few seconds of emergence from the amniotic sac, and also began to scrape their heads against the ground and obstacles which they met. Many were observed yawning very widely. The result of the scraping and yawning was apparently to loosen the outer epidermal layer which was then shed by crawling out of it, the shed epidermis being turned inside out. Most young had shed this layer within ten to fifteen minutes after birth. They used their tongues for testing within two to five minutes after birth.

Of the 32 young, 17 were males and 15 females. All were born alive except for two females which were slightly shorter in length, one being deformed in the snout region. They did not break from their amniotic sacs.

All were weighed and measured within 24 hours. The males ranged in length from 13.5 to 14.8 cm. in snout-vent length and 15.5 to 16.9 cm. in total length with an average of 14.34 (snout-vent) and 16.48 (total) cm. The thirteen living females ranged from 13.7 to 15.2 and 15.4 to 17.2 cm. respectively, averaging 14.45 (snout-vent) and 15.4 (total) cm. A slight sexual dimorphism was apparent in the tail length, the tails of the males averaging 13 per cent of the total length and the females 11.9 per cent. The range in weight for all living young was 2.2 to 2.9 grams (average - 2.63 grams).—*Charles C. Carpenter, Department of Zoology, University of Oklahoma, Norman, Oklahoma.*

ANOTHER TEXAS RECORD FOR THE LOUISIANA PINE SNAKE, *PITUOPHIS MELANOLEUCUS RUTHVENI* STULL.—The Louisiana Pine Snake, *Pituophis melanoleucus ruthveni* Stull, is one of the most rarely collected North American snakes. The present specimen brings to only 15 the number known to be extant in collections.

On 4 May 1959 the senior author and Mr. Tommy Linton were examining an acid bog four miles north-northeast of the town of Kountze, Hardin Co., Texas. The snake was apparently stalking a cottontail rabbit and probably would have been overlooked had it not begun to vibrate its tail in dired leaves.

The bog is known locally as a "hard bog," the ground being soggy for only a short time after rain. It is located within the longleaf pine belt (with one exception the area from which all other specimens of *ruthveni* have been taken), but due to lumbering activities the tree is not abundant in the area. The dominant trees surrounding the bog are the loblolly pine (*Pinus taeda*), and the shortleaf pine (*Pinus echinata*). A few large loblolly, shortleaf and

longleaf (*Pinus australis*) pines are present within the bog along with several young specimens of each of these trees. The dominant woody plants in the bog are the sweetbay, *Magnolia virginiana*, and the swamp cyrilla, *Cyrilla racemiflora*. Carnivorious plants in the bog are the sundew, *Drosera* sp., pitcher plant, *Sarracenia* sp., and the butterwort, *Pinguicula* sp. The sweetbay and the swamp cyrilla are especially dense in the northern part of the bog, and it was in this area that the snake was found.

Data recorded from this specimen are as follows: male; length, 1524 mm.; tail, 7.4% of total length; scale rows, 29-29-20; ventrals, 225; caudals, 61; rostral only slightly higher than wide, 7 mm. by 8 mm.; rostral penetrating half the length of the internasals; prefrontals, 4; preoculars, 1-1; postoculars, 4-5; upper labials, 8-10. Of the 8 on the left, the fourth enters the eye and the penultimate is the largest. Of the 10 on the right, the fifth enters the eye and the antepenultimate is the largest. Lower labials 13-14. Dorsal blotches, 37. The blotches are darkest anteriorly becoming lighter in mid-body and then darker again posteriorly. The anterior blotches run together but still remain countable. Tail spots, 8. The only linear marking on the head is an indistinct line between the eyes.

Reference of this specimen to *ruthveni* is based chiefly on the number and pattern of dorsal blotches and the lack of linear markings on the head characteristic of *sayi*. Conant, (1956: *American Museum Novitates*, No. 1781) gives as 34.9 the mean number of dorsal blotches in *ruthveni* and 51.0 as the mean for *sayi*. The anterior blotches in *ruthveni* characteristically run together whereas in *sayi* they are distinct. This specimen, however, is closer to *sayi* in the ventral scale count. Conant (*ibid*) gives as the mean number for *ruthveni* 216.4 and for *sayi* 227.6.

The range is extended slightly to the south. The previous southernmost record is given by Conant (*ibid*), as Tyler County, Tyler Field, (A.M.N.H. No. 68188). Recent correspondence with the American Museum indicates that the catalog entry for this snake is Tyler Co., Field, Texas. Study of Tyler Co. maps and personal inquiry have failed to locate any town by the name of Field. It is felt that Conant's stated locality is the proper interpretation of the catalog entry on the basis of the presence of oil fields in southern Tyler Co. The first oil field brought in Tyler Co. is now known as the Joe's Lake field located in the southeastern corner of the county. Until other fields were brought in this field was known as the Tyler Oilfield. Therefore, the specific locality of the Tyler Co. specimen is probably the Joe's Lake oil field. The present specimen was taken 18 miles southwest of the Joe's Lake oil field.—*Robert W. Mitchell, Department of Biological Sciences, Lamar State College of Technology, Beaumont, Texas,* and *Donald W. Tinkle, Department of Biology, Texas Technological College, Lubbock, Texas.*

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